NETRADIO FOR UM
(BACK-END FRAMEWORK)

By
RAZMAH BT MAHAD
WEK010235

Supervisor
MR. NOORZAILY MOHAMED NOR

Moderator
MR. YAMANI IDNA IDRIS

Submitted To
Faculty Science Computer and Information Technology
University Malaya

To Fulfill the Requirement For
Bachelor Science Computer
Session 2004/2005

DEPARTMENT OF SYSTEM AND NETWORKING TECHNOLOGY

ABSTRACT

ABSTRACT

This graduation project report was a partial requirement of the Bachelor Degree of Computer Science. This project focused on the testing and implementation of streaming. Streaming multimedia files using multicast and unicast technology through LAN with conserving network resources. It is also an effort being carried out to provide a multimedia and interactive Web-based system for Faculty of Computer Science and Information Technology.

Multimedia has become a popular catchword during the last few years. The idea behind a multimedia network is a single network combining an improving all current technologies that realizes fast and convenient access for the customer to voice and data applications.

The NetRadio concept is first conceived to solve the weakness of traditional radio in this demanding social. The NetRadio is designed to be a multimedia environment, utilizing state-of-the-art currently powerful technology to accommodate user requirement.

Since the study of multimedia broadcasting is still a new topic in computer world, only limited streaming technology available for this project. The core technology deployed in this project is Microsoft Windows Media Services, which is a powerful streaming technology use for stream all on-demand Radio programs to users.

Finally, it concludes that NetRadio can be implemented using either unicast or multicast stream and all streams will be able to provide the optimum quality if implemented in Local Area Network.

ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

In developing of the system, I have been fortunate to have many sources of inspiration and supports. Throughout the duration of the project development, many people have been very kind and sincere in lending helping hands, that giving me a lot of valuable advices and encouragement.

First of all, I would like to express my utmost gratitude to my supervisor, Mr Noorzaily Mohamed Nor in providing the guidance and advices throughout the whole development stage of my project. I am grateful to his dedication as well.

In particular, I would like to express my appreciation to my project moderator, Mr Yamani Idna Idris, for sharing his time to listen to my project's problem. He has shown patience to understand and comprehend my project besides giving me lots of beneficial advices and comments.

Special thanks also given to all FSKTM lab administrators who have made sure that all computers and other facilities in the labs are in good condition. As well as my family, friends and course mates who have give me some encouragement and support all the time.

Last but not least, I would like to thanks to my beloved partner, Ms Noraina Abdullah, for sharing her knowledge and provides much invaluable information to me, to make this project as good as possible.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

In this century, Internet and radio are the example of technologies that gives us information and entertainment around the world. There are also many parallels between radio and Internet, in their early development, regulation as well as use. Radio is an incredibly a simple technology with just a couple of electronic components. Radio has developed into a tightly regulated medium, with well-established business models and huge audiences. All radio today, however use continuous sine waves to transmit information. Radio waves transmit music, conversations, pictures and data invisibly through the air, often over millions of miles. It happens every day in thousands of different ways. Even though radio waves are invisible and completely undetectable to humans, they have totally changed society. Whether a cell phone, a baby monitor, a cordless phone or any one of the thousands of other wireless technologies, all of them use radio waves to communicate.

Anyway, besides radio, everyone knows that Internet is the most popular communication right now. The Internet is an interconnection of large and small networks around the globe. The Internet is held together by bi- or multilateral commercial contracts (for example peering agreements) and by technical specifications or protocols that describe

how to exchange data over the network. The question is will these two technologies, radio (broadcast audio) and the Internet (the Internet Protocol) to be combine? The answer is yes. Radio and Internet can be combined to provide informative, innovative and entertaining services to users. Today, the Internet is a public, cooperative and self-sustaining facility accessible to hundreds of millions of people worldwide. Physically the Internet uses a portion of the total resources of the currently existing public telecommunication networks. Technically what distinguishes the Internet is its use of a set of protocols called Transmission Control Protocol/Internet Protocol (TCP/IP). Two recent adaptations of Internet technology, the intranet and the extranet also make use of the TCP/IP protocol.

There are two ways to deliver audio over the Internet. The easiest way is simply to make audio files available for download. Compressed formats like MP3 are the most popular form of audio downloads, but any type of audio file can be delivered through a Web or FTP site.

Another way is to use streaming technology. Streaming media flows from the Internet directly to a user's sound card. It is not stored on the user's computer, but only played. It is a continuous broadcast that works through three software packages, the encoder, the server and the player. The encoder converts audio content into a streaming format, the server makes it available over the Internet and the player retrieves the content. For a live broadcast, the encoder and streamer work together in real-time. An audio feed runs to the sound card of a computer running the encoder software at the broadcast location and the stream is uploaded to the streaming server. Since that requires a large amount of

computing resources, the streaming server must be a dedicated server. Streaming makes it possible to deliver a continuous broadcast over the Internet and it is the basis of Internet radio station. Internet radio is not limited to audio. An Internet radio broadcast can be accompanied by photos or graphics, text and links, as well as interactivity such as message boards and chat rooms. This advancement allows a listener to do more than listen.

To develop an Internet radio, front-end and back-end are used to characterize programs interfaces and services relative to the initial user of these interfaces and services. A front-end application is one that application users interact directly. A back-end application or program serves indirectly in support of the front-end services, usually by being closer to the required resource or having the capability to communicate with the required resource. The back-end application may interact directly with the front-end or perhaps more typically, is a program called from an intermediate program that mediates front-end and back-end activities. These two technologies will then integrate to produce an Internet radio for computer users.

This project, NetRadio for UM will concentrate on the development of an Internet radio via Local Area Network (LAN) using streaming technology. The purpose of this project is to enhance the way of distributing information. Users especially students can get any information wherever they go and no limit for example if they go back to their hometown. Though FSKTM has its own web site, but this is another way to communicate beside short messaging system (SMS) and this project is set to be a trial phase for the faculty. Other campus already has their own Internet radio for example

Multimedia University (MMU) that has launched their Internet Radio Station on June 1998.

1.2 PROBLEM STATEMENT

The problem that most people are facing now in internet radio environment is slow server response times. Slow response times are the worst offender against Web usability. The growth in Internet-based radio stations often means that each audio delivery must be computed on the fly. As a result, the experienced delay in loading the data is determined not simply by the download delay (bad as it is) but also by the server performance. Sometimes, loading data that connect to back-end mainframes or database servers make the process slowing down. Users do not care why response times are slow. All they know is that the site does not offer good services. Slow response times often translate directly into a reduced level of trust and they always cause a loss of traffic as users take their business elsewhere.

In this NetRadio system, all of this problem can be solved by invest in a fast server and get a performance expert to review its system architecture and code quality to optimize response times.

1.3 PROJECT OBJECTIVES

In order to develop the NetRadio, the objectives of the system must be well understood to ensure that the outcome of the project meets the objectives. At a glance, the project is aimed to develop another source of information besides the faculty's web site. It also aims to create an informative, user friendly and easy access environment to the users, hence the user will not wasting time to search around to find relevant information. Through the use of the Internet, visitors can access the NetRadio from any location and anytime of a day.

The main objectives of this project are as follow:

- To provide an informative, innovative, interactive and user-friendly Web-based entertainment system for Faculty of Computer Science and Information Technology (FSKTM).

- To test and implement live streaming and encoding technology using multicast through FSKTM's Local Area Network (LAN).

- To test and implement multiple unicast streaming with conserving network resources.

1.4 PROJECT SCOPE

The most important goal of the development of NetRadio is to enable students and staff of the FSKTM to spread out information besides using faculty's web site. The system enables users to listen to the radio programs from any related links using streaming media technology.

For the back-end application, the scopes of the project are as follow:

- To serve indirectly in support of the front-end services, usually by being closer to the required resource or having the capability to communicate with the required resource.

- To interact directly with the front-end from an intermediate program that mediates front-end and back-end activities.

- To serve streams to each and every unique client requesting access.

1.5 TARGET USERS

Target users consist of two categories which are:

- **Students and Staffs of FSKTM**

  As they work in across the geographical and the boundaries, they need a collaborative technology, such as NetRadio to assist in giving information and to make any announcement.

- **Campus Student**

  The second target user is campus student that wants to know more about FSKTM and about the music.

1.6 PROJECT DELIVERABLE

This project is divided into two phases, which will be referred to as Latihan Ilmiah I and Latihan Ilmiah II. During the first phase, there would be literature review for this project, system planning, and analysis and design. For the first phase, the NetRadio is expected to produce a good proposal after depth study on how to develop Internet radio. All this need a systematic planning and methodology that is used and also analysis related to Internet radio. Finally, the system design that is suggested must fulfill the user's requirement.

The second phase for this project would be system development, testing, implementation and the last part is maintenance for the system that has developed. Documentation is done from the beginning of the project until the end of the project. At the end of this project, the NetRadio is expected to produce a Web-based system, enabling students to conduct their own radio station online.

1.7 PROJECT TIMELINE

From the Figure 1.1 below, literature review, system analysis and system design phase are specify in **WXES 3181**. While coding, testing and maintenance are in **WXES 3182.**

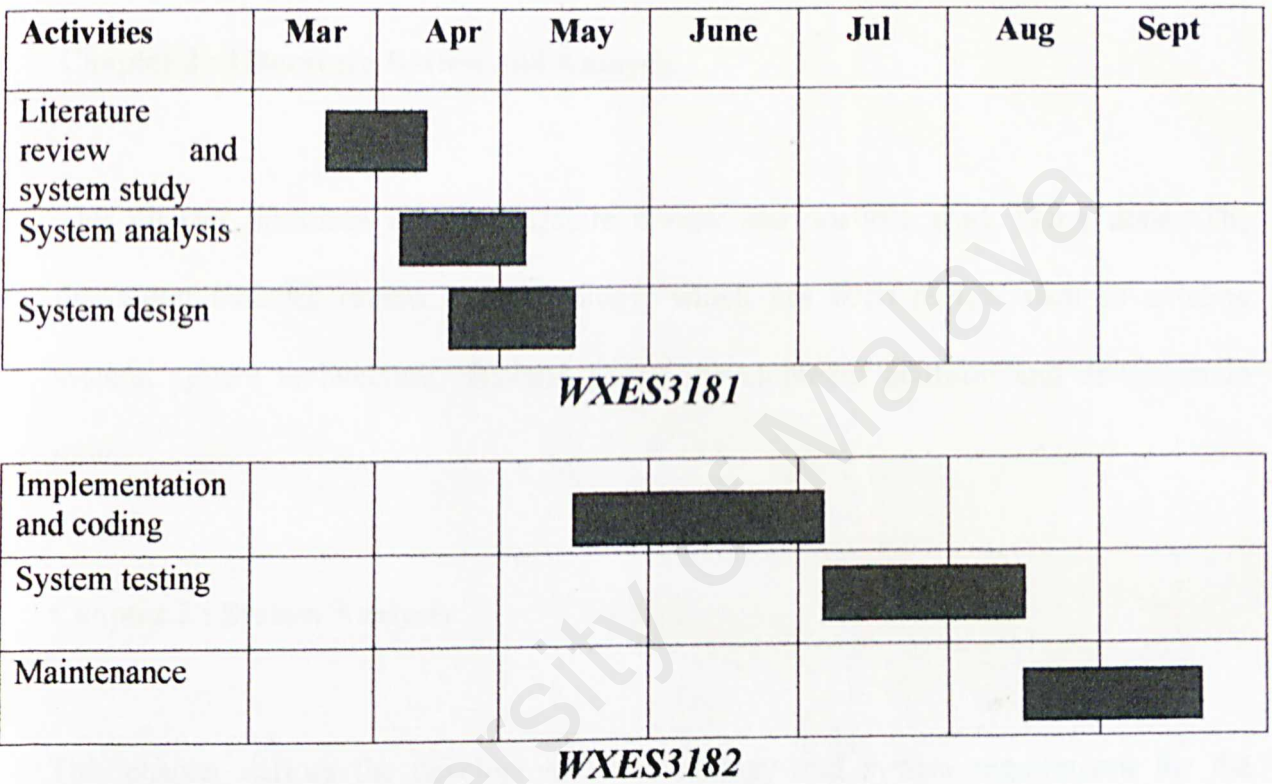

Figure 1.1: Project Schedule of NetRadio

1.8 REPORT ORGANIZATION

This report is organized into four chapters. Below is the summary of each chapter of the project.

Chapter 2 : Literature Review and Analysis

This chapter discusses all the literature review and analysis work being done. The discussion includes review on technology, which has been review such as existing system, system architecture, database server, development platform and development tools.

Chapter 3 : System Analysis

This chapter defines the development methodology and system requirement for the system. Functional and non-functional requirement are defined. In addition, it also includes the requirement for development platform, database, server, web server, web publishing technology, streaming technology and development tools.

Chapter 4 : System Design

This chapter concentrates on the design of the system architecture. Besides, it also defines the functional and database design for the system.

LITERATURE REVIEW

CHAPTER 2

LITERATURE REVIEW

2.1 OVERVIEW

A write up on a literature review for this project is considered an important stage for the prior steps in developing the system. This is where identification of the element needed is done to comprehend the yet to be developed business information system which enables understanding of the strengths, weakness, opportunity, threats, potentiality and issues surrounding the system. Literature review is the fundamental background information of developing a reliable and comprehensive system which from here will be the basic to begin the methodology and system analysis for the NetRadio project.

2.2 DEVELOPMENT TECHNOLOGY

There were a lot of development technologies available for the development of this project. All these technologies can divided into two categories, the first one part was used for audio streaming server technology and the second part will focus on web publish technology.

2.2.1 AUDIO STREAMING SERVER TECHNOLOGY

There were a lot of audio streaming server technologies provided by Real Networks, Apple's Quick Time, MP3 and Microsoft, for example Real System G2 Basic Server, Stream Works MP3 Server, Radio Destiny Broadcaster and Microsoft Windows Media Services 9 Series (Microsoft, 2004).

Microsoft Windows Media Services 9 Series

Microsoft Windows Media Services 9 Series is the best platform for delivering high-quality digital media across the Internet and corporate Intranets. It enables the seamless integration of Windows Media-formatted content into the most popular Web browsers, enabling rich Web applications to integrate enhanced multimedia presentations. Whether delivering the latest music videos on- demand to thousands of employees, Windows Media Services provides the most scalable, reliable and manageable server to meet digital media needs. Windows Media Services enables user to stream multimedia content over networks that range from low-bandwidth, dial-up Internet connections to high-bandwidth, local area networks.

Windows Media Technologies supports data delivery over a wide variety of networks and protocols. Windows Media Format describes a transmission file format for arranging and organizing synchronized multimedia data. It is optimized for streaming the data over networks and rendering the data on a client computer. Windows Media Format specifies

the format of live presentations that are being streamed across the network as well as prerecorded files.

One specialized use of Windows Media files is in streaming audio files compressed with the Windows Media Audio codec (compression/ decompression system). This codec combines very high-quality audio output with significant improvements in file compression. Of great importance to many content providers is that these files can be made much more secure from piracy by using the digital rights management (DRM) encryption system.

Servers running Microsoft Windows Media Services support unicasting (sending a stream to each client requesting it) and multicasting (broadcasting a single stream across the network so that it can be rendered by many clients at the same time). Unicasting enables the user to start, stop, pause, fast-forward or rewind stored stream data at will (if the stream is indexed). However, sending a stream to each client can require a lot of bandwidth. Much like tuning into a radio broadcast, multicasting restricts the user's ability to pause, rewind or fast-forward the presentation.

Microsoft Media Services are the appropriate choice for:

- Internet compatibility. User's application must run over the Internet. Windows Media Services were designed with the Internet in mind, but will work equally well over Intranets and extranets.

- Limited Bandwidth. Users have a limited amount of network bandwidth to work with. Windows Media Services were optimized to work with low-to mid-bandwidth networks, starting at 2.4 kilobits per second (Kbps) and going up to 3.5 megabits per second (Mbps). The majority of applications that use Windows Media Services is 128 Kbps (ISDN rates) and below. The server's Intelligent Streaming feature allows it to varying network conditions, maintaining high quality over loss networks like the Internet.
- Multicast. Users want to have multicast in addition to unicast capabilities. Multicast allows user to send a single stream to many users simultaneously, thereby conserving network resources.
- Multiple Data Type in a stream. Users are interested in combining audio, video, data, JPEG, URLs, script commands and other rich media in a single data stream. Windows Media Services stream data using the highly flexible and industry standard Advanced Streaming Format (ASF) to combine many data types into one stream.
- ASF Format. Users want to author content in ASF. This allows user to choose from a wide variety of contents authoring and encoding tools. It also ensures compatibility across streaming media clients, servers and tools.
- Codec Independence. Users require or prefer a certain codec for encoding and decoding a stream. The codec independence that is provided with Windows Media Services allows user to ensure the highest-quality streaming by providing the best compression schemes and allowing content authors to choose the most appropriate codec for their application, including MPEG-4.

- Live Software Encoding. Users require live encoding with software instead of hardware. Windows Media Services support software capturing and encoding hardware is required.
- Ad Insertion. Users require ad insertion. This allows easy, dynamic and personalized insertion of ads into video streams and Web pages through integration with Site Server ad services.

Stream works

Introducing stream works

Xing's StreamWorks offers impressive real-time MPEG audio (layer 1 and 2) and video (layer 1) technology for Windows users. ISDN users and direct 'net connectors will enjoy the ability to check out continual A/V signals from StreamWorks servers, but 28.8 Kbps and 14.4 Kbps users will likely find the waters quite a bit rougher.

In fact, at 14.4 and even 28.8 Kbps connections, real-time video is actually closer to a still image than a movie, and audio, while decent, is nowhere near the quality heard on the radio or even from competitors like RealAudio and Vivo Active. 56 Kbps users will fare better with fewer delays and overall quality nearly on the level of the competition.

StreamWorks Server Solutions

Developers can add their own scalable streaming multimedia content to Web sites by purchasing one of the StreamWorks server solutions. StreamWorks Server packages are

currently available for Windows NT (Alpha and Intel), Sun Solaris, IRIX, HP-UX, and Linux platforms.

An Uphill Battle

A variety of StreamWorks samples can be viewed from content providers using one of the StreamWorks server solutions. Most feeds are available in a variety of formats in order to meet the different needs of users (14.4, 28.8, 56, ISDN, and T1). At the highest data rates, the player is capable of full screen, full color, full motion video with CD quality, 44 kHz audio.

At the more common lower data rates, the player can still receive streamed video and synchronized high-quality audio, but performance and quality lag behind competing technologies like RealPlayer. StreamWorks is on the cutting edge of technology and will only get better in the future, but it faces an uphill battle against well-entrenched forces from the likes of Real Networks, Vivo Active and the Windows Media Player.

Real player

RealAudio was the first client released on the 'net that allowed users to download and run audio clips in real-time for example, the sound bytes run while being downloaded, not after. Since its initial release in June of 1995, RealAudio has continually evolved in order to stay one step ahead of the competition while still managing to retain its freeware status. Its affordability and reputation for outstanding audio quality are two of the reasons that RealAudio has become the most popular client of its type on the 'net.

RealPlayer: The Second Generation of RealAudio

Seeking to capitalize on its potential and augment its market share, RealNetworks (the developers of RealAudio) worked with Iterated Systems (developers of ClearVideo) to integrate ClearVideo's real-time on-demand video streaming technology into the second generation RealAudio client.

That version of the client, called RealPlayer, made it possible to view both audio and video clips on the Web at the same time and also offered another technological breakthrough called RealFlash. RealFlash allows for Macromedia Flash animations to be played in real time and in complete synchronization with RealAudio content.

RealPlayer G2

RealNetworks released the third generation RealAudio client, RealPlayer G2, in late 1999 with audio and video quality far superior to previous releases. The G2 release gets its name from the G2 music codec introduced by RealNetworks for the most advanced audio streaming technology ever.

RealPlayer G2 also supports the announced W3C standard Synchronized Multimedia Integration Language (SMIL), which allows for the layout and synchronization of multiple data types and offers a broadband multimedia experience even over low bandwidth connections.

With a head start on its only major competition (Microsoft's Media Player), RealPlayer looks to have taken the lead in what has quickly become an extremely intense race for

market share. While RealPlayer's advantage is partly due to the large number of sites that serve RealAudio and RealVideo content, another important factor results from the massive improvement made to the client in its four years of existence.

The RealPlayer client that combines RealAudio with the RealVideo, RealFlash, and new G2 technologies is a far cry from the RealAudio player introduced just over three years ago. RealAudio's mainstay has always been on-demand streaming of audio, but feature additions like live broadcast capability, real-time on-demand video capabilities via RealVideo, and real-time animation streaming via RealFlash have taken the client to new levels.

Additions like SmartStream technology (eliminates rebuffering), improved sound quality for 28.8 Kbps (stereo sound) and higher (near-CD quality) 'net connections, e-commerce support (ad insertion capabilities, for example), improved delivery technology and easy publishing tools for adding RealMedia content to our Web site have had a similar effect.

Other features that have recently been implemented in RealPlayer include bandwidth negotiation (for customizing audio quality to our connection speed), multicasting support, pseudo-streaming for small audio files, multimedia synchronization, advanced plug-in capabilities, an AutoUpdate feature that automatically downloads the latest RealPlayer components for us, and Java integration capabilities.

RealPlayer 7

RealPlayer generation five debuted with the release of RealPlayer 7. While not as revolutionary as previous releases of the client, RealPlayer 7 does add some critical and

useful new features. The release of RealPlayer 7 coincides with the debut of Real.com's Take5 entertainment showcase, which has been integrated into the new player.

Take5 offers daily updated multimedia content to users with the intent of serving as our Internet entertainment portal. The portal's content is provided by more than 100 media partners in the form of daily headlines, music news and premiers, comedy features and additional original entertainment.

RealPlayer 7 also offers a revamped user interface with enhanced media navigation features, improved MP3 performance with support for streamed MP3 content, reduced start-up time and other performance improvements, and Real.com's Message Service (e-mail news flashes).

RealPlayer 8

RealPlayer 8 continues where version 7.0 leaves off. As with the release of v7.0, RealPlayer 8 doesn't offer revolutionary changes over previous versions, but nevertheless it does sport several significant additions. The most noticeable change with v8.0 is the coinciding release of Real Entertainment Center, an audio/video streaming suite which packages RealPlayer 8 with RealJukebox 2, the RealDownload 4 client (based on NetZIP's Internet Download Manager), and an integrated Net2Phone client.

Serving RealPlayer Content

Listening to and viewing RealPlayer files is just great for the majority of us, but RealNetworks has designed their technology with another audience in mind as well.

Developers wanting to create and serve their own RealMedia content are taken care of with a line of products designed specifically for creating (RealEncoder) and serving (RealNetworks Servers) RealPlayer files.

The encoder is freeware and allows user to create and host your own clips utilizing pseudo-streaming capabilities on any type of Web server. However, in order to stream clips on the Web in real time user need to either download the freeware Basic Server client or purchase the more advanced Basic Server Plus. The freeware Basic Server offers many of the same features found in the commercial server, but it is not eligible for phone support, does not include RealFlash streaming animation, and lacks some of the more sophisticated features of the commercial server release.

RealOne Player

The latest major release of RealPlayer, RealOne Player, recently debuted with a collection of important enhancements and new features. Perhaps the most significant enhancement is the repackaging of three clients into one, RealOne Player has fused RealPlayer, RealJukebox, and RealDownload into a single multimedia deluxe client. A completely redesigned, Windows XP-style interface accompanies the integration of the clients in RealOne Player.

A step up to the premium RealOne Player Plus will give user additional features and services, including TurboPlay, full-screen video, advanced audio controls (with a 10-band equalizer), faster CD ripping (with high bit rate and variable bit rate recording), and SuperPass access. SuperPass provides 24/7 exclusive access to real-time multimedia

feeds from the likes of CNN.com, ABCNews.com, E!, NBA.com, FOXSports.com, the Animal Channel, and more, as well as access to high-quality, ad-free music radio.

Overall, RealPlayer and now RealOne Player as well is a class-act app that will appeal to anyone who has ever had to wait an eternity just to listen to a thirty-second sound byte or view a video clip. And with the increasing prevalence of Real multimedia content on the Web, this is one app user will definitely want to have for their online daily Web surfing.

While there is still considerable room for improvement in the quality of audio and video streaming technology, RealPlayer shows that user don't need to wait for the arrival of cable modems and DSL lines in order to fully enjoy real-time true multimedia content on the Web.

2.2.2 WEB PUBLISHING TECHNOLOGY

Hypertext Markup Language 4.0 (HTML)

HTML is a universally understood language and this makes it suitable for publishing information for global distribution. HTML works well across different web browsers and platforms. With HTML, developer can create online documents publishing with headings, text, table, lists, photos and others. HTML also provided some useful features like inclusion of spreadsheets, video clips, sound clips, form design and hyperlinks.

Active Server Pages 3.0 (ASP)

Active Server Pages (ASP) is a server-side scripting technology that developer can use to create and run dynamic, interactive Web server applications. With ASP, developer can combine HTML pages, script commands and ActiveX components to create interactive Web pages or powerful Web-based applications. ASP applications are easy to develop and modify. ASP unique features are listed below:

- Interactive and dynamic web pages. ASP is used to create dynamic and interactive web pages by including ActiveX controls and Java Applets. ASP has pre-built Active Server Components that provides plug-in objects that will perform specific tasks, thus providing much more flexibility in writing interactive and dynamic web pages.

- Compatibility with other web applications. ASP can be considered as a glue technology that binds together other various server-based systems to help build interactive web pages. ASP can interact with almost any existing dynamic web page technology such as Common Gateway Interface (CGI), Internet Server Application Programming Interface (ISAPI) and scripts written in PERL, Python and Awk.

- Database connectivity. ASP has an Active Server Component named Active Data Object (ADO) that allows easy but powerful connections to be made to almost

any database system available.

- Scripting languages. ASP is compatible with any ActiveX scripting language. ASP includes native support for VBScript and JScript, Microsoft's implementation of JavaScript. JScript does not offer some facilities found in VBScript. Multiple scripting languages can be used interchangeably in the same ASP file.

- Error handling and debugging. ASP's error handling and debugging features are minimal. There is no control over the way that the code is executed. To debug the script, values of variables have to be inserted into the page.

Command Gateway Interface (CGI)

The Common Gateway Interface (CGI) is a standard for interfacing external applications with information server, such as HTTP or Web servers. A plain HTML document that the Web daemon retrieves is static, which means it exists in a constant state: a text file that doesn't change. A CGI program, on the other hand, is executed in real-time, so that can output dynamic information.

Since a CGI program is executable, it is basically the equivalent of letting the world run a program on your system, which isn't the safest thing to do. Therefore, there are some securities precautions that need to be implemented when it comes to using CGI programs.

Probably the one that will affect the typical Web user the most is the fact that CGI programs need to reside in a special directory, so that the Web server knows to execute the program rather than just display it to the browser. This directory is usually under direct control of the Webmaster, prohibiting the average user from creating CGI programs. There are other ways to allow access to CGI scripts, but it is up to your Webmaster to set these up for users.

A CGI program can be written in any language that allows it to be executed on the system, such as:

i.) C/C++
ii.) Fortran
iii.) PERL
iv.) TCL
v.) Any Unix shell
vi.) Visual Basic
vii.) AppleScript

JScript

JScript is the Microsoft implementation of the ECMA 262 language specification. It is a full implementation, plus some enhancements that take advantage of capabilities of Microsoft Internet Explorer. JScript is an interpreted, object-based scripting language. Although it has fewer capabilities than full-fledged object-oriented languages like C++ and Java, JScript is more than sufficiently powerful for its intended purposes.

JScript is not a cut-down version of any other language (it is only distantly and indirectly related to Java, for example) and it is not a simplification of anything. It is, however, limited. You cannot write standalone applications in it, for example, and it has little capability for reading or writing files. Moreover, JScript scripts can run only in the presence of an interpreter, either in a Web server or a Web browser. JScript is loosely typed language. That means we do not have to declare the data types of variables explicitly. Moreover, in many cases JScript performs conversions automatically when they are needed. For instance, if we try to add a number to an item that consists of text (a string), the number is converted to text.

VBScript

Microsoft Visual Basic Scripting Edition (VBScript) is a subset of the Microsoft Visual Basic language. VBScript is currently available as part of Microsoft Internet Explorer and Microsoft Internet Information Server. When used in Microsoft Internet Explorer, VBScript is directly comparable to Microsoft JavaScript. VBScript code, like JavaScript, does not produce standalone applets but is used to add intelligence and interactivity to HTML documents.

VBScript is a pure interpreter that processes source code embedded directly in the HTML. It is implemented as a fast, portable, lightweight interpreter for use in World Wide Web browsers and other applications that use Microsoft ActiveX Controls, Java applets and Automation server.

VBScript provides three separate classes of objects, namely objects provided by the VBScript engine, Internet Explorer and web page author. The VBScript engine provides the core run-time functionality. Microsoft Internet Explorer provides the vast majority of objects used in scripting. In generally useful is provided directly in VBScript.

2.3 SYSTEM ARCHITECTURE

There are generally two types of client/server architecture use for development purposes. They are two-tier and three-tier architecture. Each type of architecture had advantages and disadvantages. The choice between a two- and three-tier architecture should be based on the scope and complexity of a project, the time available for completion and the expected enhancement or obsolescence of the system.

2.3.1 TWO-TIER ARCHITECTURE

The two-tiered architecture contains two computers: a client and a server with areas of logic combined on the client. The three components of an application presentation, processing and data are divided among two software entities or tiers: client application code and database server. A robust client application development language and a versatile mechanism for transmitting client requests to the server are essential for a two-tier implementation. Presentation is handled exclusively by the client, processing is split between client and server, and data is stored on and accessed through the server. The PC client assumes the bulk of responsibility for application (functionality) logic with respect

to the processing component, while the database engine with its attendant integrity checks, query capabilities and central repository functions handles data intensive tasks. In a data access topology a data engine would process requests sent from the clients as show in Figure 2.1. Currently, the language used in these requests is most typically a form of SQL. To send the SQL, the client must know the syntax of the server or have it translated by an API (application program interface). Data returned to the client can be manipulated at the client level for further subsection, business modeling, what-if-analysis and reporting.

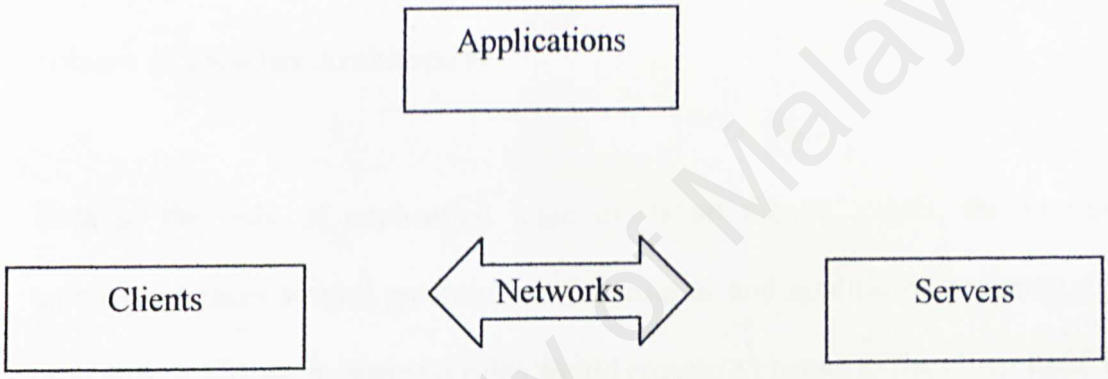

Figure 2.1 : Two-tier System Architecture.

Advantages of Two-tier Architecture

- Application development speed is the most compelling advantage of a two-tier environment. In most cases, a two-tier system can be developed in a small fraction of the time it would take to code a comparable but less-flexible legacy system.

- Most tools for two-tier are very robust and lend themselves well to iterative prototyping and rapid application development (RAD) techniques, which can be used to ensure that the requirements of the users are accurately and completely met.

- Two-tier architectures work well in relatively homogeneous environments with fairly static business rules. They are less suitable for dispersed heterogeneous environments with rapidly changing rules.

Disadvantages of Two-tier Architecture

- Because the bulk of application logic exists on the PC client, the two-tier architecture faces several potential version control and application redistribution problems. A change in business rules would require a change to the client logic in each application in a corporation's portfolio affected by the change.

- System security in the two-tier environment can be complicated because a user may require a separate password for each SQL server accessed. The proliferation of end-user query tools can also compromise data base server security.

- Client tools and the SQL middleware used in two-tier environments are also highly proprietary and the PC tools market is extremely volatile. The volatility of the client/server tool market raises questions about the long-term viability of any

proprietary tool an organization may commit to and complicates implementation of two-tier systems.

2.3.2 THREE-TIER ARCHITECTURE

The components of three-tiered architecture are divided into three layers: a presentation layer, a functionality layer and the data layer. Each of these layers must be logically separate. The three-tier architecture attempts to overcome some of the limitations of the two-tier scheme by separating presentation, processing and data into separate distinct entities. Figure 2.2 shows three-tier system architecture. The same types of tools can be used for presentation as were used in a two-tier environment, however the tools are now dedicated to handling just the presentation. When the presentation client requires calculations or data access, a call is made to a middle-tier functionality server. This tier performs calculations or makes requests as a client to additional servers. The middle-tier servers are typically coded in a highly portable, nonproprietary language such as C. Middle-tier functionality servers may be multithreaded and can be accessed by multiple clients, even those from separate applications. Although three-tier systems can be implemented using a variety of technologies, the calling mechanism from client to server n such a system is most typically the remote procedure call or RPC (remote procedure call). Because the bulk of two-tier implementations involve SQL messaging and most hree-tier systems utilize RPCs, examination of the merits of these respective equest/response mechanisms is warranted.

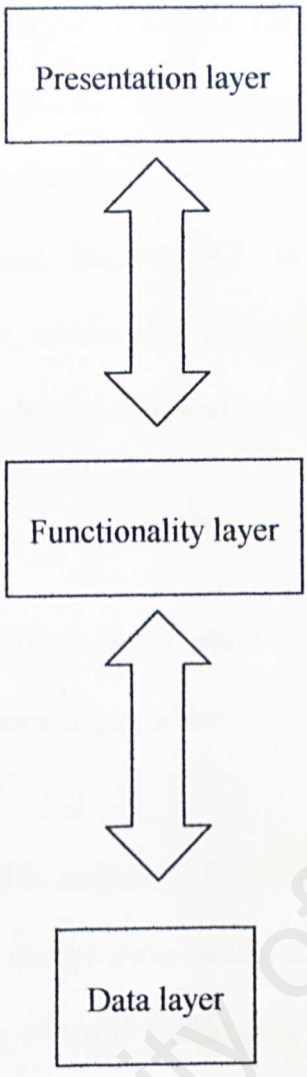

Figure 2.2 : Three-tier System Architecture.

Advantages of Three-tier System Architecture

- RPC calls from presentation client to middle-tier server provide greater overall system flexibility than the SQL calls made by clients in the two-tier architecture. This is because in an RPC, the requesting client simply passes parameters needed for the request and specifies a data structure to accept returned values.

- Unlike in most two-tier implementations, the three-tier presentation client is not required to understand SQL. As such, the organization, names, or even the overall structure of the back-end data can be changed without requiring changes to PC based presentation clients. Because SQL in no longer required, data can be organized hierarchically, relationally or in object format. This added flexibility allows a firm to access legacy data and simplifies the introduction of new data base technologies.

- Having separate software entities allows for the parallel development of individual tiers by application specialists.

- Provides for more flexible resource allocation. Middle-tier functionality servers are highly portable and can be dynamically allocated and shifted as the needs of the organization change. Network traffic may be reduced by having functionality servers strip data to the precise structure required before distributing it to individual clients at the local area network (LAN) level.

- Modularly designed middle-tier code modules can be reused by several applications. Reusable logic reduces subsequent development efforts, minimizes the maintenance workload and decreases migration costs when switching client applications.

- A three-tier system such as Open Software Foundation's Distributed Computing

Environment (OSF/DCE) offers a variety of additional features to support distributed applications development.

Disadvantages of Three-tier System Architecture

- Three-tier brings with it an increased need for network traffic management, server load balancing and fault tolerance.

- Current tools are relatively immature and require more complex 3GLs for middle-tier server generation. Maintenance tools have underdeveloped facilities for maintaining server libraries a potential obstacle for simplifying maintenance and promoting code reuse throughout an IS organization.

2.4 DATABASE CONSIDERATION

Database technology is used in a variety of applications. Some serve only a single user on a single computer while others are for multiple users. There are variety types of database like Microsoft SQL Server 7.0, Oracle 8i, Sybase, Informix and also Microsoft Access. In order to choose a reliable database, the database must be able to ensure the safety and security of the data. The database is at the core of all mission-critical applications. Choosing the wrong database can have drastic downstream results. The investment in software, implementation and development of a database system is substantial, it needs to be able to evolve with the changing requirements of a growing company.

2.4.1 MICROSOFT SQL SERVER 7.0

Microsoft SQL Server is a significant tool in many regards. From data warehousing to applications that require not only a large amount of information but also many different simultaneous users, SQL Server is a key component in answering data management requirement. It is a powerful and comprehensive database.

Microsoft SQL Server is a perfect example of an n-tier system. The user can manipulate the data directly from the client side. Most of the time, the data is validated first before it is updated into the database in server side. It is tightly integrated with the Microsoft BackOffice family product to enable organization to improve decision-making and streamline the business process. It is the best database for Windows NT Server.

Microsoft SQL Server maintains referential integrity and security and ensures that operation can be recovered in the event of numerous types of failure. SQL Server can control the access for the type of information that can be retrieved by the user. SQL Server supports Internet database integration. It allows the user to automate the publishing of database information in HTML documents. It allows user to build active web sites and let user conduct processes on the Internet. When combining with Internet Information Server and the SQL Server Internet Connector, it gives user to complete Internet database publishing capabilities. It provides the function for transparent distributed transactions. This means that it provides automatic distributed update capability across two or more SQL Server transparent to the desktop application, making

it a simple to use. It guarantees the integrity of transaction of updating spanning multiple servers.

2.4.2 ORACLE 8I

Oracle is the world's loading vendor of database software. Oracle's ability to have all data and documents stored in a small number of high performance databases benefits customers by centralizing all their data, making information management and access easier, more reliable and less expensive. The ground breaking capabilities of Oracle8i's Internet File System (iFS) provides a single, easy to use data management interface for all data types, thus minimizing customers' reliance on a proprietary operating system. Oracle is an open solution and it supports all kind of platform.

Oracle's advanced security features allow for enforced granular privileges, advanced auditing, enhanced access control, secure distributed processing and replication and the ability to use additional external authentication mechanisms. Oracle uses a Java-based utility that provides everything needed to get a pre-tuned and pre-configured Oracle 8i database up and running. Oracle Enterprise Manager provides a single integrated management console for central administration of multiple servers. It also contains some advance functionality for tuning and diagnosing the database and managing complex change in the database environment.

2.4.3 MICROSOFT ACCESS 2000

Microsoft Access is the most popular Relational Database Management System (RDBMS). With Access, database administrator can design and use databases very much quicker, as it provides a very user-friendly interface. Furthermore, tables, forms, queries and reports can be generated just at the snap of a finger by using the set of wizards that come with this software. All this makes Access an excellent all in one database tool for creating standalone database applications.

2.5 WEB SERVER TECHNOLOGY

2.5.1 APACHE 1.3

Apache 1.3 is a great web server, which serves pages for the vast majority of the web. Apache modules may now be loaded at runtime, this means that modules can be loaded into the server process space only when necessary, thus overall memory usage by Apache will be significantly reduced. DSO currently is supported on FreeBSD, OpenBSD, NetBSD, Linux, Solaris, SunOS, Digital UNIX, IRIX, HP/UX, UnixWare, NetWare, AIX, Reliant Unix and generic SVR4 platforms. Apache now experimentally supports the Windows NT and Windows 95 operating systems and also NetWare 5.x operating systems. But there are things Apache 1.3 can't do. Firstly, it isn't particularly scalable on some platforms. AIX processes, for example, are very heavy weight and a small AIX box serving 500 concurrent connections can become so heavily loaded that it can be impossible to telnet to it. In situations like this, using processes is not the right solution.

2.5.2 INTERNET INFORMATION SERVER 4.0 (IIS)

Microsoft Internet Information Server 4.0 is fully integrated at the operating system level, which allows publication and distribution of information on the Internet. IIS 4.0 is optimized for Windows NT Server 4.0 and takes advantage of the security that NT Server provides. IIS 4.0 consists of three different components: World Wide Web (WWW) server, File Transfer Protocol (FTP) server and Gopher server, which support virtual servers, virtual directories, logging to ODBC database, Common Gateway Interface (CGI), Internet Server Application Programming Interface (ISAPI) and Secure Sockets Layer (SSL).

Virtual Server allows allocation of several IP addresses to any single NIC. This means that it is possible to have one machine act as though it is several different servers. By assigning a different Home directory to each IP address, type of access to each of those Home directories can be customized. Another added benefit of a virtual server is that it allows all IIS services to reside on one machine, instead of having to use separate hardware for each server needed.

Document meant for publishing is usually located in specific home directory. This will simplify the process of configuring the directory for publishing purposes. However, if the information resides in different directories or in several computers for that matter, copying those files to the home directories can be a daunting task. Virtual directories enable the specification of those locations without the need to copy those files to the

intended directory. In other words, virtual directories make sharing information a simple process.

IIS helps in ensuring that the log files maintained by the administrator do not occupy too much disk space. IIS provides two options in logging server activities. The first option is to log those activities in text files. The second option is to log the activities into an ODBC-compliant database. This will require setting up the database. The information saved consists of the client's IP address and username, the date and time, the name and IP address of the server, the service used, the processing time, bytes received and sent, and a few others bits.

In security aspect, IIS uses two methods, password authentication and access control to access services. For password authentication, IIS requires a valid username and password for authentication in order to gain access to the information. The usernames must be valid usernames on the computer running IIS or from a Windows NT domain accessible from the IIS machine. As for access control, the server is made available to only machines within the IP domain. Restricting access to a certain individual IP address can also be done. Securing data transmitted is done with Secure Sockets Layer (SSL) that provides communications via data encryption.

2.6 DEVELOPMENT PLATFORM

Different kinds of application will run in different platform. However, most of the application available in the market is only support one kind of platforms. Following are the platform that takes into consideration:

2.6.1 MICROSOFT WINDOWS NT SERVER

Microsoft Windows NT is one of the powerful operating systems for business computing. It combines the ease-of-use of Windows 95 with the power and reliability of Windows NT. NT is also a powerful OS that reliable, secured, multithreaded, symmetric processing, support client/server system.

There is an extensive security support in NT. NT can control the access control of user in accessing certain file or application. Besides, NT supports a wide range of networks protocol and Remote Access Protocol. This makes it easy for us to develop the distributed application. Windows NT Server is a complete platform available for building and hosting web-based application. It is the best platform to publish and share information securely over corporate Intranet and Internet. It is so reliable that when an application have problem it doesn't crash the whole program.

Windows NT allows Object Linking and Embedding (OLE). It can combine the information from several applications into one compound document using the special

OLE capabilities of window-based application. Windows NT also enables the capabilities of integrating applications on a single computer or even across multiple computers.

2.6.2 UNIX

UNIX is an increasingly popular operating system. Traditionally used on minicomputers and workstations in the academic community, UNIX is now available on personal computers and the business community has started to choose UNIX for its openness.

UNIX, like other operating systems, is a layer between the hardware and the applications that run on the computer. It has functions that manage the hardware and functions that manage the executing of applications. UNIX includes the traditional operating system components. In addition, a standard UNIX system includes a set of libraries and a set of applications. It includes the file system and process control and a set of libraries.

One of the greatest strength of UNIX is the consistent way in which it treats files. It is very easy for the users to work with files because users don't need to learn special commands for every new task. Besides UNIX is not known only for its longevity and versatility as an operating system but also for the variety and number of utility programs that called tool.

2.6.3 MICROSOFT WINDOWS XP

Microsoft Windows XP operating system was a major event for the computing industry Windows XP's robust, easy to use operating system and usability enhancements are changing the way home and office user's computer. Windows XP is great for customers because it builds on the consistent experience people. Windows XP is designed more for users who may not be familiar with all of Windows features and has several new abilities to make the Windows experience easier for those users. Windows XP includes various new features not found in previous versions of Microsoft Windows. Some of the new features are new interface (a completely new look and ability to change the look), updates (new features that automatically obtains updates for the Internet) and multilingual support (added support for different language).In addition to the above features Windows XP does increase reliability when compared to previous versions of Microsoft Windows.

2.7 REVIEW OF EXISTING SYSTEMS

http://radio.mmu.edu.my/

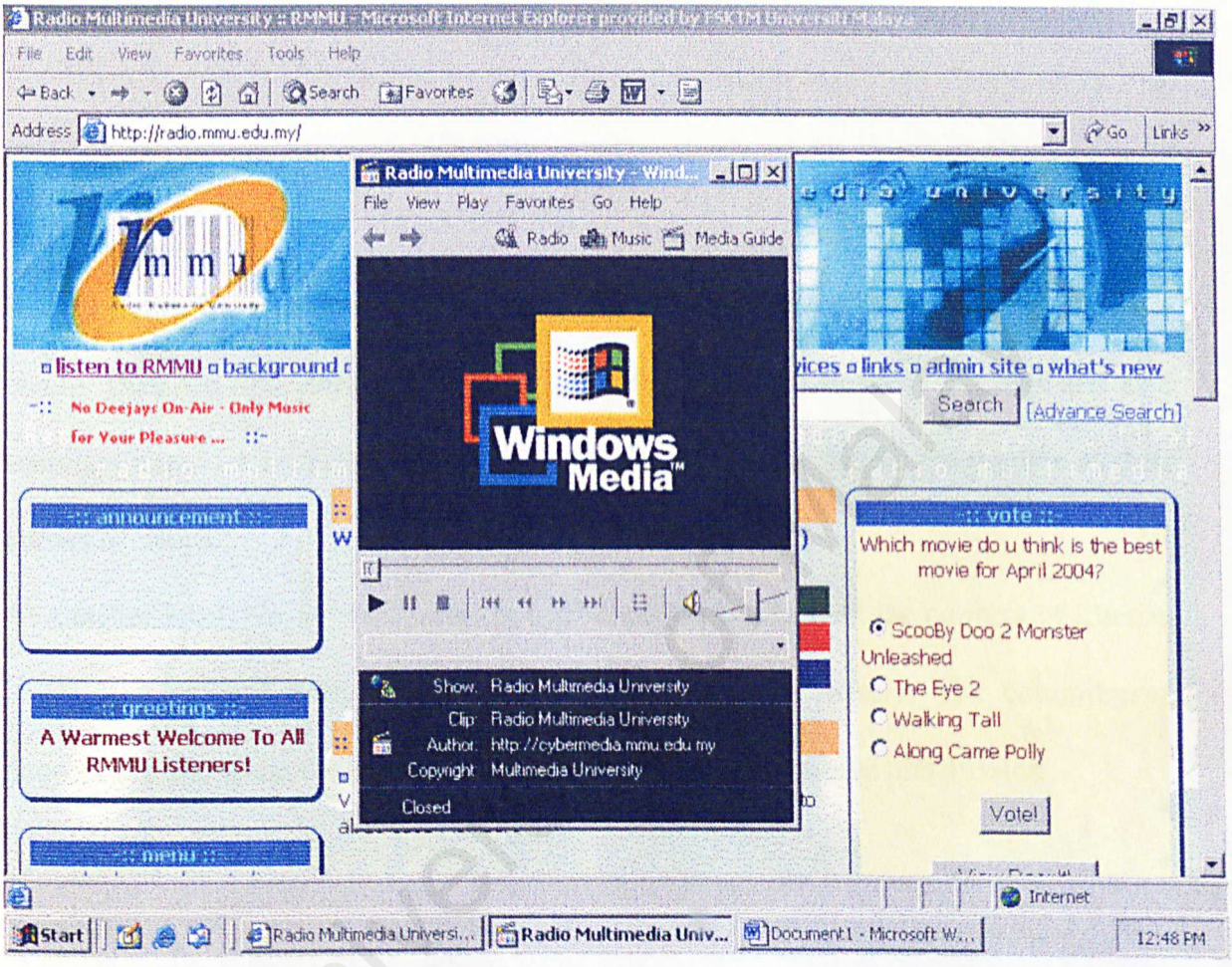

Figure 2.3 : radio.mmu.edu.my interface

Overview

Radio Multimedia University studio is located at the lower ground floor of the Faculty of Engineering building in MMU Cyberjaya Campus, Selangor, Malaysia. The Radio

Station is an important edutainment unit of the University designed to serve the students and the wider community by providing sensational music and information using the Internet Radio technology. Presented on the virtual communication medium (Internet), Radio MMU can be listened worldwide using Real Player at a very considerable bandwidth 32-56 Kbps.

Mission

Radio Multimedia aims to serve as one of the instructional resources used to deliver high quality Distance Education programme for the Multimedia University students and as a training ground for new deejays and students undertaking the Deejay Programme as their curricular subject.

At a higher level, Radio MMU aims to introduce Malaysian with the concept of Internet Radio and educate them on how to use this technology wisely. The commitment, cooperation and talents will be important aspects in order to achive this mission.

Facilities

Music is played using the CD player, Cassette Player and also PC. 3 microphones are available for deejays and their invited guests. Two phones are also available for receiving incoming calls to Radio MMU. All deejays are required to master the skills of controlling the mixer system, ensuring suitable volume of output for encoding purposes. Deejays are also equipped with 3 headphones to listen to the output of their encoded program.

Technical Equipments

The technical equipment will ensure the transmission of the radio shows is in the best quality from the radio to listeners. All devices used by the deejays must be in a tip-top condition as the radio runs 24-hours a day. The output from mixer will be transmitted directly to the third computer for encoding session using Real Player Encoder. These encoded data will be sent to MMU server for live webcast.

Pros:

- The system is user friendly and interactive. It is suitable for all level of listeners.
- The Radio Station is designed to serve the students and the wider community by providing sensational music and information using the internet radio technology.

Cons:

- This system may require a high capacity bandwidth to ensure the transmission of the radio shows is in the best quality from the radio to listeners.

http://www.era.fm/

Figure 2.4 : era.fm interface

Era.fm is one of the most popular radio stations in Malaysia. It is Malaysia's number one most listened to radio network with over four million loyal listeners. It is also the nation's first all Bahasa Malaysia private radio network. Era.fm has stride further with developing their radio station on Internet. It means that listener can listen to this radio station via Internet. Users can listen to Era.fm with Digital Visual Radio Player (DVR) that can find on Era website. DVR player enhances the listener's experience by adding visuals to radio, which has become possible through the convergence of digital audio, text and

graphics technology and introduces, for the first time in Asia, "Radio with Pictures". The DVR player has launch on Era.fm on 14th August 2000.Before that, users have to register first to get their log in ID and password before they can listen to the radio. Era.fm functions on operating systems such as Windows 95, Windows 98, Windows ME, Windows XP and etc.

Pros:

- Listeners can find lot of information about the radio station, programs and others.
- User friendly system.
- Need a password to login the system to make sure the system is secure.

Cons:

- Limited users because the radio station just used in Malay section.

http://www.hitz.fm/

Figure 2.5 : hitz.fm interface

Hitz.fm is one of the Astro radio like Era.fm beside other six terrestrial FM radio stations. Hitz.fm is Malaysia's number one English speaking all Top 40 radio network and is the first radio station in Malaysia to merge with the Internet in catering to the needs of the net savvy teens today. Hitz.fm award winning website includes interactive programmes such as the Late Net Show and Equest, live webcasts and online chat sessions with station

personalities and guest artistes. Like Era.fm, Hitz.fm also need DVR player to listen to the Internet radio. This DVR player includes text and high resolution graphic images are simultaneously displayed with the radio programs and include information about the song title, artiste and album of music tracks currently being played, plus photos of on air-personalities.

Pros:

- The system is user friendly and interactive. It is suitable for all level of people.
- There is much information given.
- This system enables listeners to participate in at anytime and from anywhere.

Cons:

- This system may require a high capacity bandwidth to make the process smoothly.

2.8 LITERATURE SYNTHESIS

There are many of system that similar to my project topic, "NetRadio" but this three existing system are the best for my literature review. This three existing system are quite a competition for my future system on creating internet radio. The summarization is as below:

- The cost of the system is too high for my project.
- Most of the system had a very specific target user such as user that registered only can listen to their radio station. This made the use of system very limited.
- This system required a high capacity bandwidth which is out of my scope.

2.9 CHAPTER SUMMARY

In process of developing the NetRadio project, extensive research is done to understand the various available web-programming technologies for server side and client-side, web servers, databases, development platforms and other useful technology. Furthermore research also conducts in different methodologies that are vital and important to the NetRadio project development. All this research is important components that are needed to develop an effective, efficiency, comprehensive and better project.

The next chapter will mainly discuss the methodology that is going to be used in the process of system development and latest technology that have been chosen in web-based system's development and implementation.

METHODOLOGY

CHAPTER 3

METHODOLOGY

3.1 OVERVIEW

Methodology can be defined as a collection of procedures, techniques, tools and helping in performing documentation. The purpose of methodology is to explore the processes of developing software and save the time in system development. Each methodology has it own distinct objectives. In this chapter, an overview of the proposed methodology for this project is discussed.

3.2 SYSTEM DEVELOPMENT PHASES

Theoretically, software is developed in several levels called phases. All the phases will form a life cycle known as System Development Life Cycle (SDLC). Overall, SDLC can be divided into 6 phases. The phases are Planning Phase, Analyzing Phase, Designing Phase, Coding Phase, Testing Phase and Operation and Maintenance Phase.

3.2.1 REQUIREMENT SPECIFICATION

The activities in Planning Phase are:

- Establish the objectives and the needs of the system.
- Estimate the scope of the system.
- Schedule planning.
- Establish the necessity of the system.
- Output documentation.

The output of the planning phase is in the form of a report. The data and procedures will be clearly stated in the project report.

3.2.2 REQUIREMENT ANALYSIS

The main purpose of this phase is to establish the need of the software. Further research and discussion are very important for understanding the purpose of the software. Analyze the collected information is very critical before proposing of any new software. Despite of user's needs, the organizations needs will be established also. The main output of this phase is software specification, which will state clearly the functions of the software in order to achieve the objectives of the software.

3.2.3 SYSTEM DESIGN

System design is important in interpreting functions of the proposed system. Each process and relationship between processes will be explained clearly in this phase. Designing will involve the activities which will separate the program into smaller and structured modules. Normally, the module will be in the form of pseudo code. Pseudo code is some kind of algorithm which can be understood easily. System design will consider other aspects likes back-end design, database design and system design of the NetRadio.

3.2.4 CODING

Coding is the activity which will convert or interpret the design into programming codes. Normally, programmer will be in charge in writing programming codes. If there are errors, programmer needs to recompile again the codes until the program is free from errors.

3.2.5 TESTING

Although all the errors can be detected, but it doesn't mean that the program is error free. The developed software need to be checked and identified before being used by the end users.

3.2.6 OPERATION AND MAINTENANCE

Before users use the program that successful in testing phase, training will be given to ensure that they can operate the program correctly. Maintenance is needed if there are any changes in the software.

The changes will be based on several factors:

- The errors that can not be detected.
- The program needs to upgrade if required by users.
- The changes of the environment.

3.3 PARADIGM OF SYSTEM DEVELOPMENT

Paradigm (process of software development) is referred to overall software development process. Each paradigm of software development will contain several phases. Each phase have it own objective. For example, analyzing phases using Waterfall Model will contain the objectives that are well defined to satisfy the need of the users.

In this section, the paradigms will be discussed are Waterfall Model, Prototyping Model and Waterfall with Prototyping Model.

3.3.1 WATERFALL MODEL

The principles of the Waterfall Model are:

- It is a series of steps (like production step).
- Each step is well defined.
- Each step creates a definite product.
- Each product forms the basic of the next step.
- The correctness of each step can be check.

The strengths of the Waterfall Model are:

- It divides a complex task into smaller, more manageable tasks.
- Each task produces a well defined deliverable.

One of the drawbacks of a strict a waterfall model is that the water cannot flow upwards if a problem is found at a particular stage in development, there is no way to influencing an earlier stage in order to rectify the problem. To overcome this drawback, a variant of the waterfall model provides for feedback between two stages, so that a problem uncovered at one stage can cause remedial action to be taken at the previous stage.

So the reality of the Waterfall Model is that development does not proceed linearly, step by step. Instead there is commonly frequent feedback to earlier stages, requiring rework.

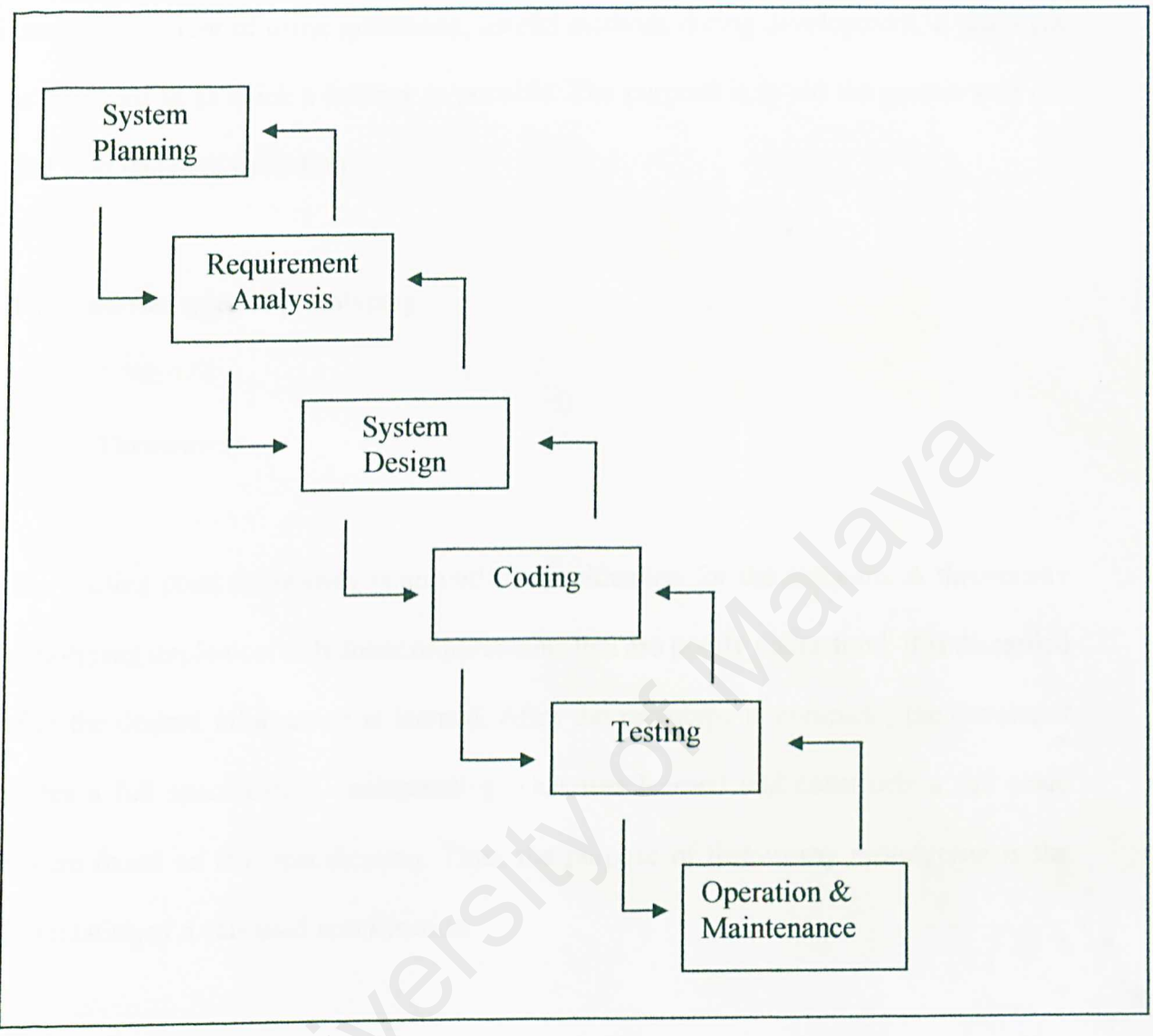

Figure 3.1 : The Waterfall Model

3.3.2 PROTOTYPING MODEL

Prototyping presents one solution to the problem in Waterfall model. In prototyping, the customer is presented at a very early stage with a working version of the system. (It may not be a complete system, but it is at least apart of the system and it works). They can

check that it does what they want, or specify modification. Prototyping seems to contradict current of using systematic, careful methods during development, a prototype is produced in as quick a manner as possible. The purpose is to aid the system will do- that is to facilitate validation.

There are two types of prototyping:

- **Throwaway**

The starting point throwaway is an outline specification for the software. A throwaway prototyping implement only those requirements that are poorly understood. It is discarded after the desired information is learned. After the prototype is complete, the developer writes a full specification, incorporating what was learned and constructs a full scale system based on that specification. Thus, the purpose of throwaway prototyping is the formulation of a validated specification.

- **Evolutionary**

Evolutionary prototyping is based on the idea of developing an initial implementation, exposing this to user comment and refining this through repeated stages until an adequate system has been developed.

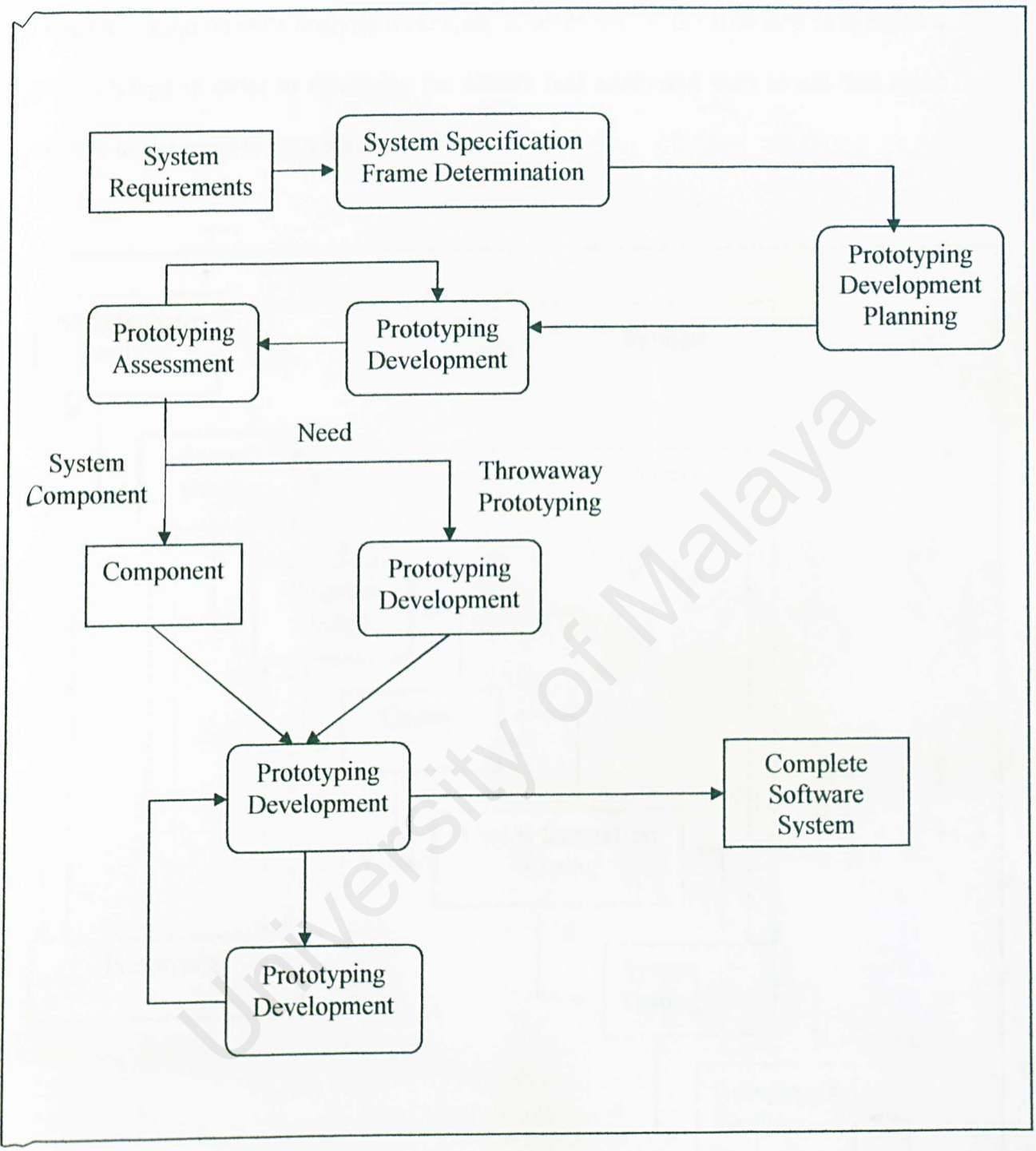

Figure 3.2 : The Prototyping Model

Despite the many successes of the Waterfall model, it has a major drawback in that what is delivered to the client may not be what the client really needs. The prototyping model

has also many successes. One solution is to combine the two approaches. Prototyping can be used as a requirements analysis technique, in other words, the first step is to build a rapid prototype in order to determine the client's real needs and then to use that rapid prototype as the input to the waterfall model.

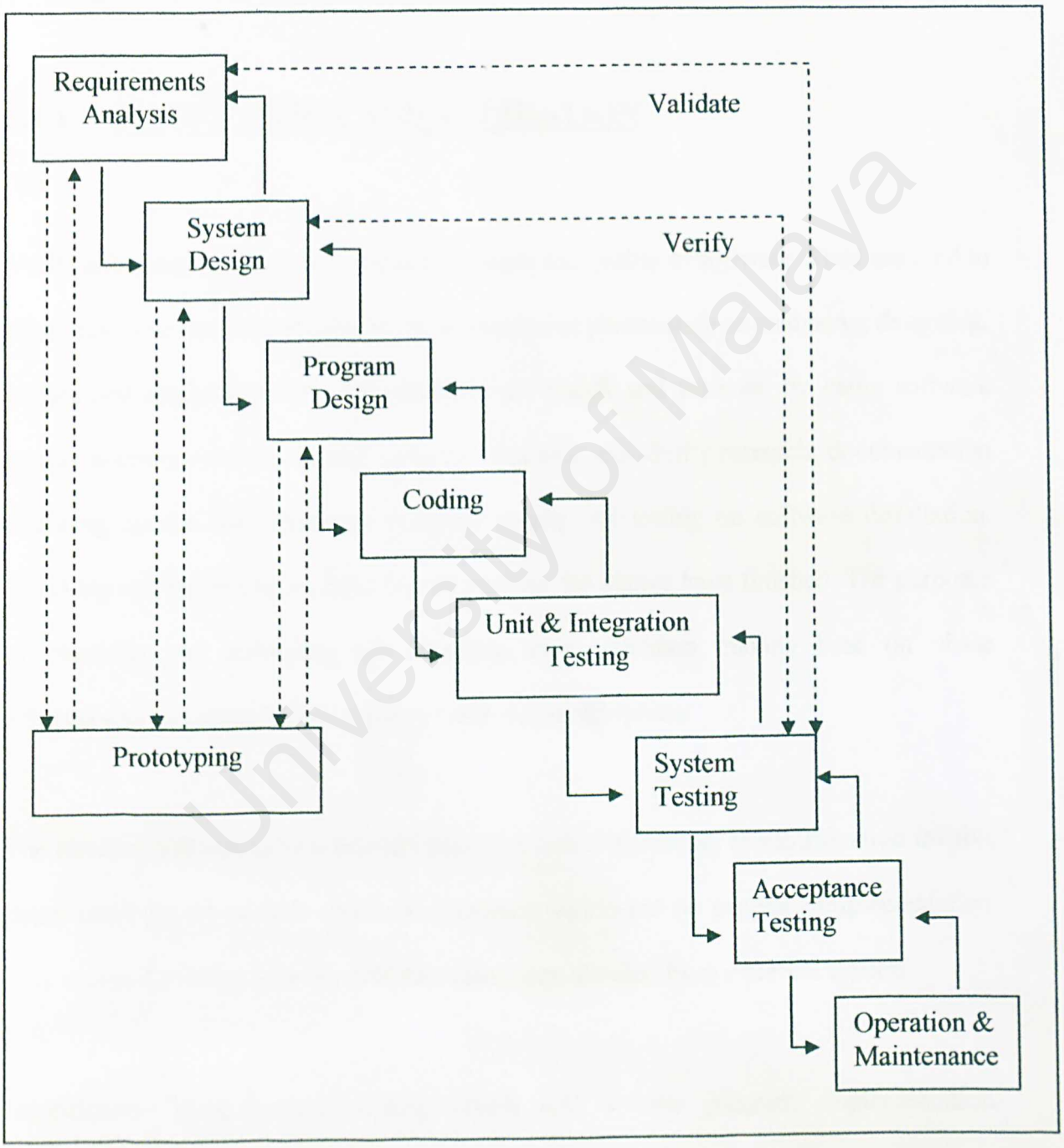

Figure 3.3 : The Waterfall Model with Prototyping

3.4 JUSTIFICATION OF METHODOLOGY

In the proposed project Net Radio, the type of software development model has been chosen is Waterfall with Prototyping. This is because the model has it own attributes and advantages as the following:

3.4.1 VERIFICATION AND VALIDATION

Verification and validation is a method to ensure the quality of software. They are used to check and estimate the activities in the development phases such as analyzing, designing, coding and implementation. The activities are check and estimate by using software quality assurance such as formal technical checking, possibility research, documentation checking, source code checking, program testing and testing on software installation. Checking and estimating no need to wait until all the phases have finished. The purposes of checking and estimating are detecting error, decision making base on phase achievement and estimate the quality of software development.

The obvious differential between identification and evolutionary is identification involve detail checking which will check on document and is not on program implementation. This means it will see how the activities have been develop from different aspects.

Identification is a dynamic testing which will involve program implementation. Identification is related to external testing or testing at the ending of the development

activities to establish or to ensure that it can function normally and satisfy the users needed.

In Figure 3.4, the static testing is occurring in analyzing phase, design phase and coding phase. Dynamic testing is occurred in analyzing phase and after coding.

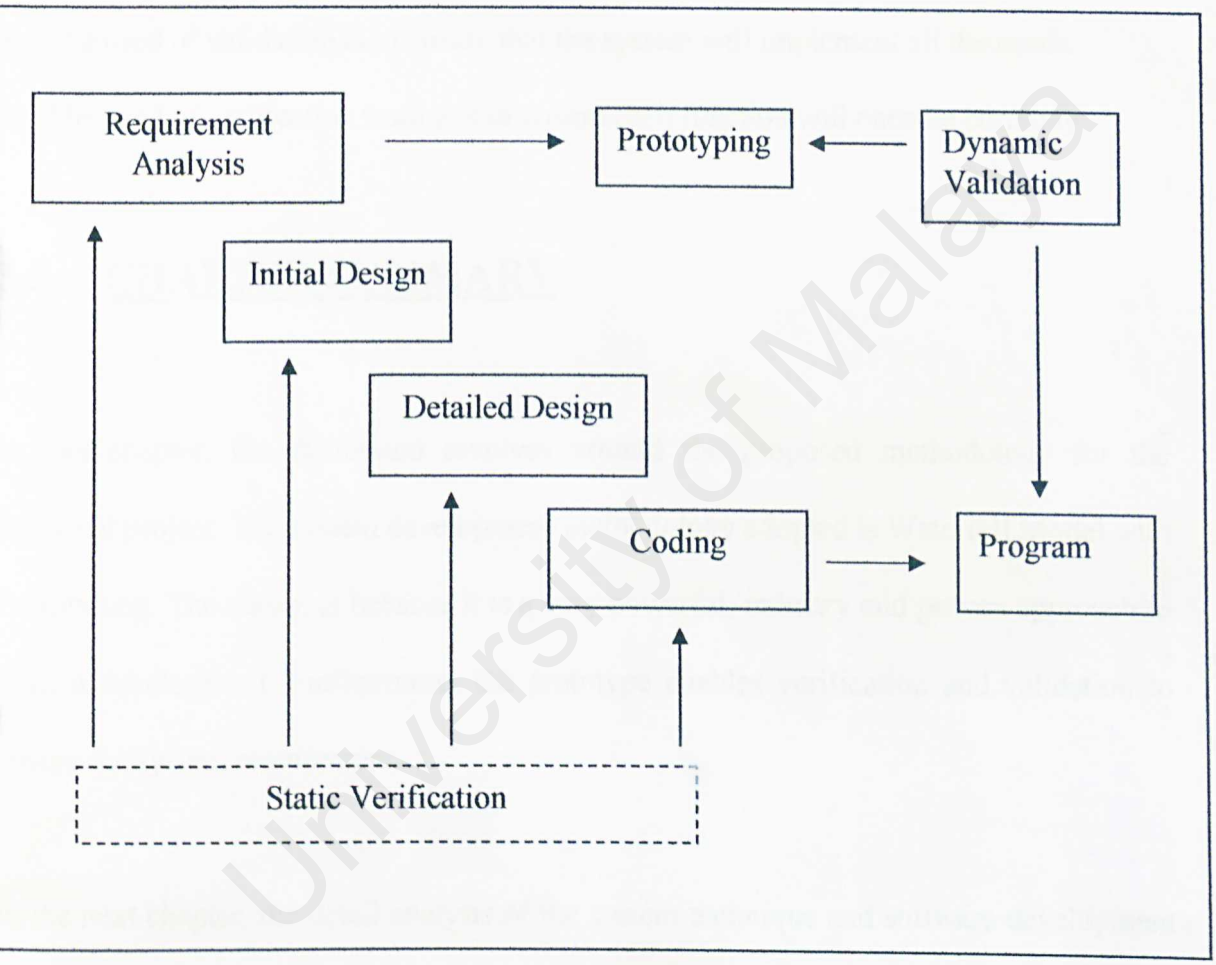

Figure 3.4 : Concepts of Verification and Validation

3.4.2 ADVANTAGE OF WATERFALL WITH PROTOTYPING

- Level of system development can be established easily.
- Easily to separate one level from the other.
- Can estimate the activities that need to be execute in system development.
- Prototyping is used to monitor each level.
- The used of validation is to ensure that the system will implement all the needs.
- The used of verification testing is to ensure each function will execute correctly.

3.5 CHAPTER SUMMARY

In this chapter, the discussion revolves around the proposed methodology for the proposed project. The system development methodology adopted is Waterfall Model with Prototyping. The reason is because it is a very powerful, industry and proven approach to system development. Furthermore, the prototype enables verification and validation to ensure the system requirement.

In the next chapter, the detail analysis of the system technique and software development tools in developing the Net Radio for back-end part will be discussed.

SYSTEM ANALYSIS

CHAPTER 4

SYSTEM ANALYSIS

4.1 OVERVIEW

System analysis is a process of gathering and interpreting facts, diagnosing problems and using the information to recommend improvements to the system.

The objective of the analysis is to examine and understand the system flow of the existing system so that better procedures or methods can be introduced to improve the system.

In this phase, the information collected through the fact-finding methods has to analyze carefully, highlight problems of the system and present it in proper format.

System analysis phase also is conducted to analyze and determine the functional and non-functional requirements of this project. Besides, it is used to determine the programming language, database and hardware need for NetRadio project. Upon completing the analysis, a combination of various kinds of tools will be determined and used to build NetRadio.

4.2 SYSTEM PLANNING

System planning and method of gathering information about the system that is going to develop is important to understand the domain of the system and also its requirements. Research and study on existing system had been done to find out how existing systems were developed and implemented. All related information collect from literature review is from reading newspaper, senior report and article from internet. Brainstorming is used in preparing system requirement base on the result from analysis on all information collected from literature review. System requirements for NetRadio can be divided into two segments, functional requirement and non-functional requirement.

4.2.1 FUNCTIONAL REQUIREMENT

NetRadio's functional requirements describe the services that the system should provide to fulfill the system requirements and also describe the interaction between the system and its environment.

- **Listening Radio Programs**

  The system should enable users listening local radio station programs using their own computer within Faculty of Computer Science and Information Technology's Local Area Network by just click on a hyperlink. The hyperlink should bring users to a web page, which Windows Media Player had embedded as an object in the page. Users

should also provide a schedule about what type of radio programs will online.

- **Searching**

The system should allow users to search and play their favorite music in system's database. This search should enable user to determine the song required. The results from the database search should only provided songs that the users are allow to access only.

- **Contact**

An interactive facility should provide to all system's users. User can send some comment or suggestion to local radio station via email for example Era.fm and Hitz.fm. Users can also contact NetRadio administrator for any information or provide some useful suggestion for the improvement of NetRadio system.

- **Related links**

The system should also provided extra linking to others services, which had provided by other company or organization. User should provide a list of available linking and a brief description about what type of programs provided by those organizations.

4.2.2 NON-FUNCTIONAL REQUIREMENT

Non-functional requirements on the other hand describe the properties and restrictions on the system that limits the choices for constructing a solution for the problems. Consideration for non-functional requirements are describes below.

- **Reliability**

Reliability is an important issue in the development of NetRadio because it will greatly influence the performance of the streaming process. This system should not produce costly failure and unexpected operation when it used in a normal condition. Any disconnection should not occur during streaming process to clients.

- **Scalability**

The scalability is to promise the capability of the system to support the increase usage of the system. Scalability in this system is maximum streaming can be done in one time. To maintenance the scalability of this system, distributed system architecture was implemented. Broadcast and encoding functionality are located in different machine.

- **Efficiency**

Respond time for the system for any user request should be within reasonable time frame for example searching song in system's database and establish connection to broadcast server. However reliability will consider as main requirement compare to efficiency because these two properties are exclusive to each other.

- **On-Time**

The system should be developed within the given time frame. In this period of time, all the requirement and also testing should be completed.

- **Manageability**

The modules within the system should be easy to manage. This will make the maintenance and enhancement works simpler and not times consuming.

- **Flexibility**

The system should have the capability to take advantage of new technologies and resources. The system should be able to be implemented in the changing environment.

4.3 SYSTEM ANALYSIS

4.3.1 SYSTEM ARCHITECTURE

The NetRadio overall application infrastructure will be based on three-tier architecture as show in Figure 4.1. System architecture design for NetRadio can be divided into two portions, live broadcasting radio programs and music on-demand.

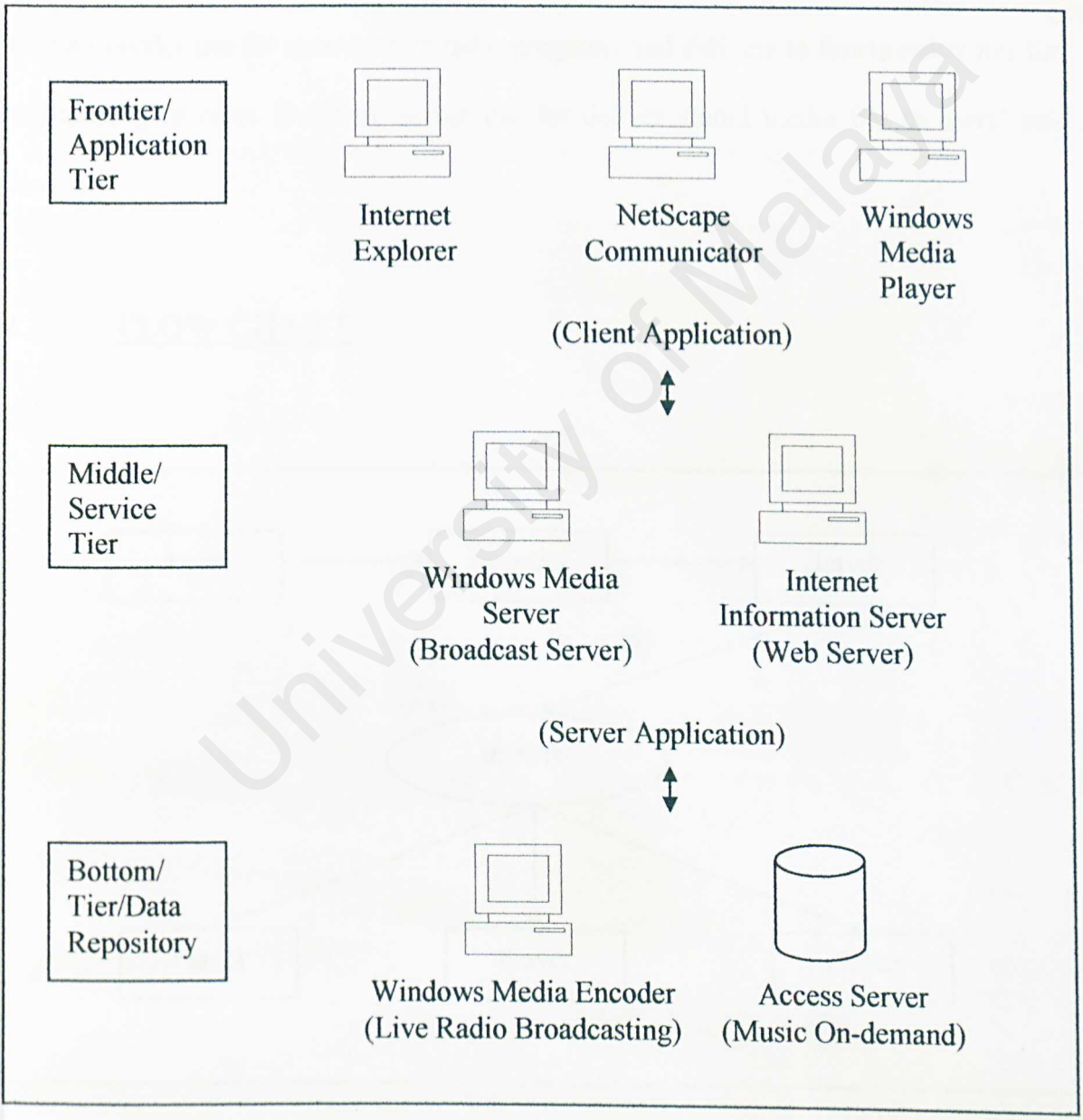

Figure 4.1: NetRadio System's Architecture

The application tier is comprised of web publishing application and Windows Media Player that will be responsible for presenting information to the users. For the NetRadio system, client-side application will require a web browser (Internet Explorer or NetScape) and Windows Media Player installed. The functionality tier will use IIS to manage web services as well as provide authentication of NetRadio users. Windows Media Services use for broadcasting using unicast and multicast, which depends on what type of services required. The bottom tier includes the database server and Windows Media Encoder use for encodes live radio programs and delivers to functionality tier for multicasting to users. Database server use for deliver stored media file to users' on-demand.

4.3.2 FLOW CHART

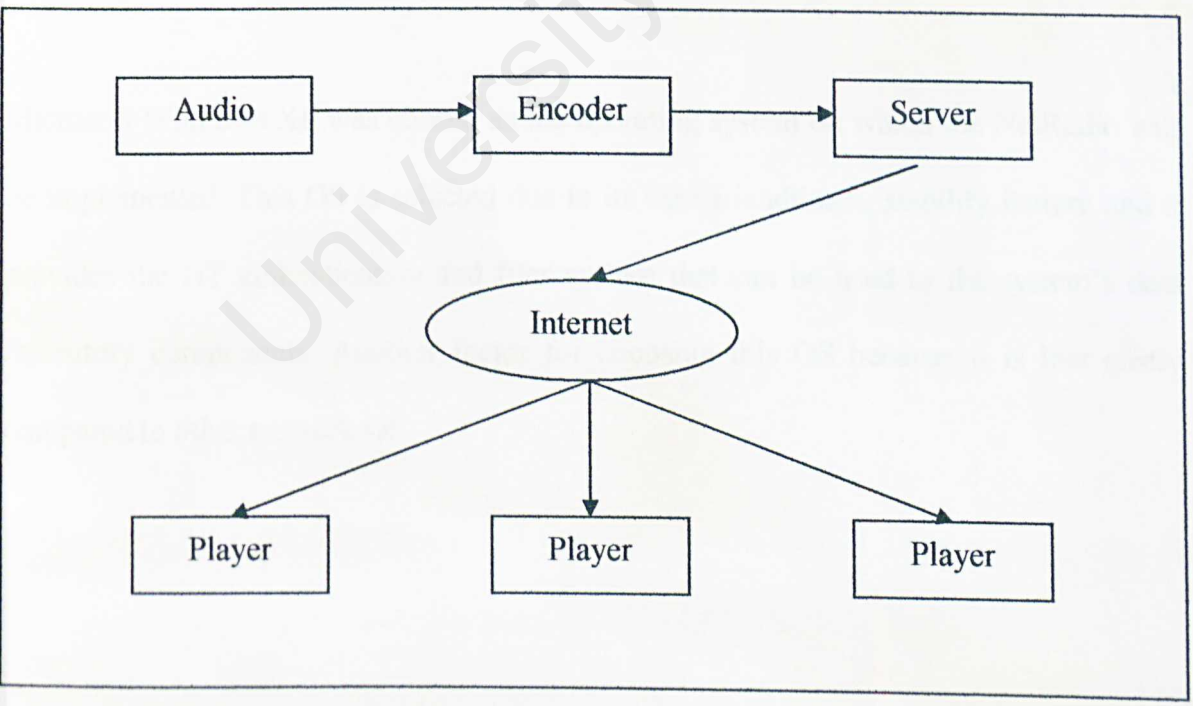

Figure 4.2: Flow Chart of NetRadio's Audio Streaming Broadcast

The flow of data and the major components of an audio streaming broadcast of NetRadio system are shown in Figure 4.2. The audio enters the encoding computer through an installed sound card. The encoder system translates the audio from the sound card into a streaming format and sends it to the server. The server sends the audio data stream over the Internet to the player software on the listener's computer.

4.4 TECHNOLOGY CONSIDERATION

Through system analysis, tools and technology suitable for the development of this project had been determined. These tools and technology include development platform, database, web server, streaming server and web publishing technology.

Development Platform

Microsoft Windows XP was chosen as the operating system on which the NetRadio will be implemented. This OS is selected due to its user friendliness, stability feature and it provides the NT authentication and files system that can be used in the system's data repository components. Another factor for choosing this OS because it is less costly compared to other network OS.

Database

Microsoft Access 2000 is choosing as the back end database for NetRadio project. Microsoft Access is chosen for its scalability, reliability and high performance. The fact that it is designed to meet the requirement of distributed client-server computing makes it a suitable candidate for the NetRadio. Ease-of-use is accomplished through Access's graphical management tools was also one of the main factor why Microsoft Access 2000 is chosen.

Web Server

Internet Information Server 4.0 (IIS) is chosen as the web server because it is bundled with Microsoft XP Server, which makes it really ease to implement even faced with a limited budget for project development cost. In a broader sense, IIS provides a comprehensive web server and web-publishing system designed especially for use with Microsoft XP Server. It is also allows security feature to be implemented on specific virtual directories to control access.

Streaming Server

Microsoft Windows Media Services 9 Series is chosen as the audio streaming server because it is the best platform for delivering high-quality digital media across the Internet and corporate Intranets. Whether delivering the latest music videos on-demand to

thousands of users, Windows Media Services provides the most scalable, reliable and manageable server to meet digital media needs. Windows Media Services enables user to stream multimedia content over networks that range from low-bandwidth, dial-up Internet connections to high-bandwidth within LAN.

Web Publishing Technology

Active Server Pages (ASP) is chosen as main web publishing technology. ASP is able to generated normal HTML file to return to user on demand, which will increase system performance. Any changes to ASP files do not required those files to be compiled. This feature makes the development work easier. The ease with ASP files can be edit is also one of the major factors, which ASP considers as the main publishing technology.

One of the advantages ASP has over CGI is improved performance. When the browser requests for a CGI application file, the server loads the file and execute it. The application itself creates an HTML file which is then assembled into a temporary page on the server, packaged up for HTTP transmission and sent to the browser. With ASP, the browser actually references the pages it wants and the page is read into memory. However, before the page is transmitted back to the browser, the server examines the page for any scripts. The server will execute any scripts that are found only. The script can change the HTML page itself by inserting values or adding extra text or HTML codes. Once the page is ready, the server will package it up in the HTTP wrapper and sends it off to the browser.

Another drawback of CGI is the difficulty of changing program's code. Whenever a CGI program written in C or C++, for example had been changed, the program has to be recompiled for the changes to take effect. In ASP, the changes would be made in the scripting language, directly in the web pages itself. Therefore, no recompilation is required.

4.5 HARDWARE AND SOFTWARE REQUIREMENT

The following is the hardware and software requirements are mainly depends on NetRadio system requirements.

4.5.1 HARDWARE REQUIREMENT

Computer Processor	: Pentium II 266 MHz or higher.
Hard Disk Space	: 2 GB or higher.
Memory	: 128 MB RAM or higher.
Accessories	: other standard computer peripherals that includes mouse, keyboard and monitor.
Drives	: CD-ROM Drive.

4.5.2 SOFTWARE REQUIREMENT

Operating System	: Windows XP
Database Server	: Microsoft Access 2000
Web Server	: Internet Information Server 4.0 (IIS)
Web Technology	: Active Server Pages (ASP)
Web Application Language	: HTML
Web Browser	: MS Internet Explorer 4.0 or above
	: Netscape Navigator 4.0 or above.
Streaming Server	: Microsoft Windows Media Services 9 Series

Minimum Hardware Requirement for Client

- Reasonable amount of RAM to support graphic.
- Network connection through existing network configuration or modem.

Minimum Software Requirement for Client

- MS Internet Explorer 4.0 or Netscape Navigator 4.0 or above.

4.6 CHAPTER SUMMARY

This requirement specification and analysis part give more precise description of the functionality and the constraints on the system after the feasibility studies on the overall available technologies. It is an important phase to ensure that the project will meet the real requirement of the project and to reduce the misunderstanding and misinterpretation of the whole system.

In chapter 5, the system design will be discussed. It will consist of logical system design, which is database design and server architecture.

SYSTEM DESIGN

CHAPTER 5

SYSTEM DESIGN

5.1 OVERVIEW

Design is the creative process of transforming the problem into a solution and the description of the solution. System design is the essential nucleus of the software development process and is applied regardless of the development model or standard that is used. The common steps involved analyzing, designing, coding and testing the system to ensure that it conforms to the software specification and requirement. Each activity transforms information in a manner that ultimately results in validated computers software. This chapter describes in detail of how this system will meet the requirements identified during system analysis.

5.2 LOGICAL SYSTEM DESIGN

In logical system design, there is a designing of database design, network design, server design and server architecture. These designs will basically show the system in more details.

5.2.1 DATABASE DESIGN

A database is defined as a collection of data stored in a particular format and reached through a computer. The NetRadio system uses the relational database model in its database implementation. This is because it enables data to be stored in a way that minimize duplicated data and eliminates certain type of processing error that can occur when data are store in other ways.

Under this model, data are stored in table and rows. Columns can be used to contain data that relate one row to another row and create desirable relationship between the tables. With all these features, relational model provides an effective way to structure and process a database. The database that is used for this system is Microsoft Access 2000. It contain all the user friendly features, works more efficiently and has the ability of handling hundreds of transactions simultaneously without affecting performance.

There are four tables in the database for the proposed system. The following tables present the data elements in this system.

Table 5.1: Administrator

Fieldname	Type	Size	Description
Admin_ID	Integer		Admin identification number (Primary Key)
Admin_username	Varchar	20	Username for login
Admin_password	Varchar	12	Password for login

Admin_fname	Varchar	20	First name
Admin_lname	Varchar	20	Last name
Admin_email	Varchar	30	Email
Admin_tel	Integer	12	Telephone number

Table 5.2: Song

Fieldname	**Type**	**Size**	**Description**
Song_ID	Integer	3	Songs identification number (Primary Key)
Song_name	Varchar	50	Name of the song
Artiste_name	Varchar	50	Name of the artiste
Album	Varchar	50	Song's album
Time_lapse	Integer	3	Total time of the song

Table 5.3: Announcement

Fieldname	**Type**	**Size**	**Description**
Announcement_ID	Integer		Announcement identification number (Primary Key)
Announcement_date	Varchar	20	Announcement date
Announcement_content	Varchar	5000	Announcement content
Announcement_title	Varchar	200	Announcement title

Table 5.4: Schedule

Fieldname	Type	Size	Description
Schedule_ID	Integer		Schedule identification number (Primary Key)
Schedule_day	Varchar	20	Day of the program
Schedule_date	Integer	20	Date of the program
Schedule_time	Integer	3	Time of the program
Schedule_program	Varchar	200	Radio's program

5.2.2 SERVER ARCHITECTURE

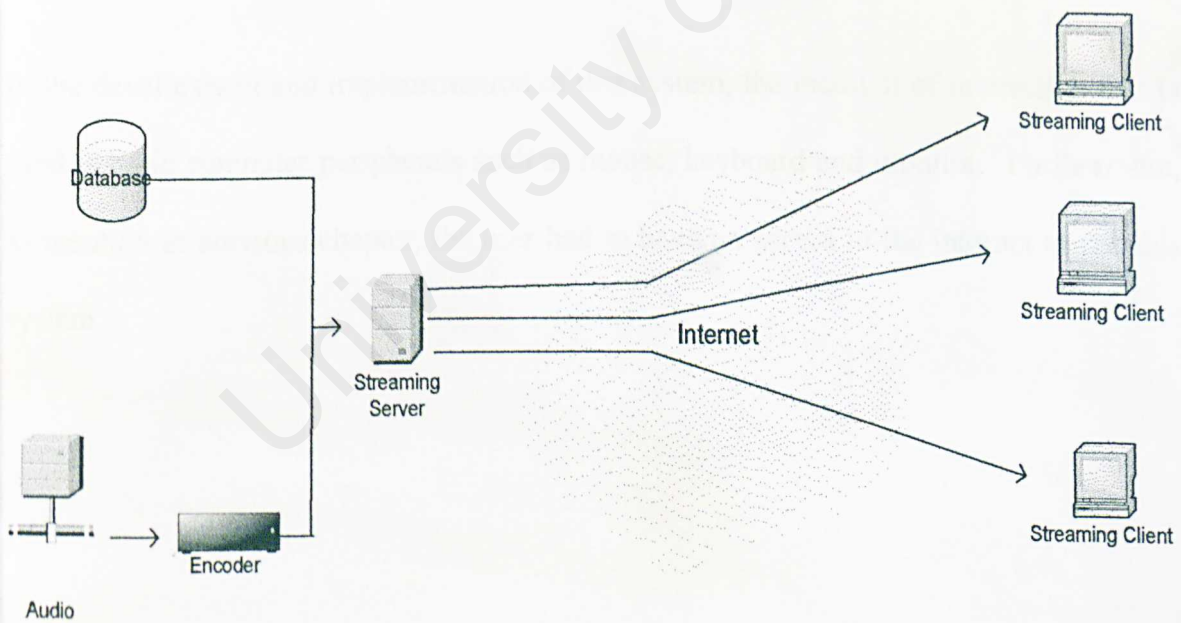

Figure 5.1: Server Architecture

In this NetRadio system, the streaming media works through a triad of software packages that is encoder, server and client. The encoder converts audio content into a streaming format, the server makes the content available over the Internet and the client or player retrieves the content. The encoder and server work together in this system.

5.3 PHYSICAL SYSTEM DESIGN

A physical system design is as those tasks that focus on the specification of a detailed computer based solution. It shows not only what a system is or does, but also how the system is physically and technically implemented. They are implementation dependent because they reflect technology choices and the limitation of those technology choices.

In the development and implementation of this system, the medium of interaction that is used is basic computer peripherals such as mouse, keyboard and monitor. Furthermore, as mention in previous chapter, the user had to have an access to the internet to use this system.

5.4 CHAPTER SUMMARY

This chapter clearly showed the process of the NetRadio system. As was illustrated in the data flow, system design is driven by the technical concerns of the system designer. The data flow and database design of the NetRadio will help to develop the system during the implementation stage.

In the next chapter, the system implementation in developing the NetRadio for back-end part will be discussed.

SYSTEM IMPLEMENTATION

CHAPTER 6

SYSTEM IMPLEMENTATION

6.1 OVERVIEW

System implementation is a phase or process of converting a system specification into an executable system (Sommerville, 2001). It takes place right after the system design phase. This phase describes how the initial and revised process design put into the real work. Therefore, system development, coding methodology and development tools are included in this phase.

6.2 DEVELOPMENT ENVIRONMENT

The development environment of NetRadio application consists of software and hardware configuration. Using the suitable hardware and software will help in speed up the system development. The hardware and software tools that used to develop and document the system will be discussed as below.

6.2.1 HARDWARE CONFIGURATION

The hardware configurations used for developing the system are:

Computer Processor	: Pentium II 266 MHz or higher.
Hard Disk Space	: 2 GB or higher.
Memory	: 128 MB RAM or higher.
Accessories	: other standard computer peripherals that includes mouse, keyboard and monitor.
Drives	: CD-ROM Drive

6.2.2 SOFTWARE CONFIGURATION

The software tools that have been used to develop NetRadio are:

Operating System	: Windows NT
Database Server	: Microsoft Access 2000
Web Server	: Internet Information Server 4.0 (IIS)
Web Technology	: Active Server Pages (ASP)
Web Application Language	: VB Script
Web Browser	: MS Internet Explorer 4.0 or above : Netscape Navigator 4.0 or above.
Streaming Server	: Microsoft Windows Media Services 4.0

6.3 NETRADIO SYSTEM IMPLEMENTATION

The development of NetRadio system was implemented by module. Each module was developed and tested separately. After that all modules was combined and integrated to form the system. As the back-end part, the following lists the implementation of each module in detail.

6.3.1 CODING MODULE

The methodology used in the development of the NetRadio system is the Waterfall Model with Prototyping. For the coding module, a prototype was created and tested. This prototype only had basic functions of the module. After that, testing and improving on prototype process is repeated until a functional and precise prototype is created. Finally the entire prototype were combined and integrated to form the final application.

- **ASX Metafile**

An ASX metafile is an .asx file that provides information that Microsoft Windows Media Player uses to receive unicast streams, multicast streams and other supported media from an intranet or the internet. Some of the ASX metafiles was created automatically after the multicast station was created. In order to provide on-demand stream to client, ASX metafile were created base on the template code shown in figure 6.1 below.

```
<ASX version="3.0">
  <Entry>
    <ref HREF="mms://ServerName/PublishingPointAlias"/>
  </Entry>
</ASX>
```

Figure 6.1: Template for create ASX metafile

6.3.2 MEDIA FILE MODULE

This was a very challenging module because it required a lot of research and understanding in WMA standard. It required Windows Media Encoder to convert audio file to the active streaming format.

- **Converting .mp3 to .asf**

This converting process was relatively simple because it involve audio file only. One converter required in this process. Windows Media Encoder (WME) was use in converting .mp3 file format to .asf file format. Windows Media Encoder must be configured to create and stream Advanced Streaming Format (ASF) information.

Steps to Configure Windows Media Encoder

1. Start **Windows Media Encoder.**
2. In the welcome window, select **broadcast, capture or convert a file using the New Session Wizard.** Click **ok**.
3. In the New Session Wizard, select **convert an audio or video file into a Windows Media File**. Click **Next.**
4. In the **File to convert**, browse MP3 file and in the **File to create,** set a destination files to ASF file. Then click **Next**.
5. Choose **Audio for FM radio quality for dial-up modems (28.8 Kbps stereo)** and then click **Next**.
6. In the new window, add in **Display Information** for Artist Name and etc. Then click **Next**.
7. In the Settings Review click **Finish**.
8. When advice panel appear, click **ok**. Then the screen image shows the conversion process progress.
9. When done, the next windows open. **Close** the session.
10. Then open **Windows Explorer** and browse to the folder that save ASF file. Actually it is WMA file.
11. Select a song that contain in the file, right click and rename the **.wma** to **.asf**

6.3.3 BROADCASTING MODULE

This module was required to build up unicast stations for NetRadio to broadcast services to the client using WMS.

- **Creation of Virtual Directory**

Before any broadcasting station created user must be able to this system from their PC attach to the LAN, a virtual directory named webradio had been created in this IIS web server using Internet Service Manager. The virtual directory is corresponds to the actual directory where all the system pages are found. This directory has read and executes rights only. Another virtual named ASXRoot had also created to store all .asx files, which use for redirect the connection to a particular stream. The creation of this virtual directory enables users to receive unicast streams, multicast streams and other supported media from the system.

- **Unicast Publishing Points**

Microsoft Windows Media Player uses a publishing point to connect to a Windows Media server and receive unicast streams. Since each Microsoft Windows Media Player has its own connection to the server, aggregate bandwidth consumed on the network can be a concern. There are two types of publishing points. An on-demand publishing point specifies a directory path to stored .asf files. The second type is called a unicast broadcast

publishing point. This type is used to stream live broadcasts from a Windows Media Encoder.

Steps to play on-demand ASF files

1. Locate an **ASF** file in the **Home unicast publishing point** directory. To find the path to the Home directory, in the menu frame, click **Unicast Publishing Points**. In the **On-Demand** Unicast Publishing Points list, locate the Home unicast publishing point alias and note the directory under Path.
2. Open **Microsoft Windows Media Player.**
3. On the **File** menu, click **Open**.
4. Type **mms://**servername/filename **.asf**, where servername is the name of server running Windows Media Services and filename is the name of the ASF file that want to play, and then click **OK**.

Steps to create a broadcast unicast publishing point using the advanced method

1. In the Windows Media Administrator menu frame, click **Unicast Publishing Points**. The Unicast Publishing Points page appears.
2. On the Unicast Publishing Points page, make sure that the **Use wizard to create new broadcast publishing point** check box is not selected.
3. Click **Broadcast** and then click **New**. The New Broadcast Publishing Point page appears.

4. In the **Alias** dialog box, type the name of the new broadcast publishing point.
5. In the **Path type** dialog box, choose the Windows Media component that will provide the live stream; Windows Media Encoder, a remote publishing point, or a remote station.
6. In the **URL** dialog box, type the path to the source identified in the **Path type** dialog box. MSBD protocol must be used for the URL.
7. If chose Windows Media Encoder as the **Path type**, in the **Port** box, type the port that the encoder is using to deliver the source.
8. (Optional) To restrict the maximum number of clients that can connect to this publishing point, choose **Limit to** from the pull-down menu and then type the maximum number of clients.
9. (Optional) To restrict the maximum amount of network bandwidth that the publishing point can deliver, choose **Limit to** from the pull-down menu and then type the maximum value in the **Kbits/sec** box.

6.4 CHAPTER SUMMARY

The development of NetRadio has been carefully planned and it does take a period of precious time. A lot of the functionalities as described in the previous chapter have been implemented orderly in time. Some functions that are not fully implemented would be extended in future. In short, NetRadio has fully utilized the Microsoft Technologies to build up the system. Whether the application is strong enough to be the security tool depends on the testing.

The next chapter would draw the system testing procedures on NetRadio.

SYSTEM TESTING

CHAPTER 7

SYSTEM TESTING

7.1 OVERVIEW

Testing is done to ensure that the system works properly and to introduce techniques that can be used to test programs to discover program faults. Testing provides a method to discover logical error and to test the system reliability. Testing is done throughout system development, not merely at the end of system development. If a system failed after installation will result a waste in cost, time and effort. However, successful testing will result in quality software with less errors and work according to specification.

7.2 TESTING OBJECTIVES

The objectives of system testing are as follow:-

- To identify, isolate and correct as many bugs as possible. Most of the programs have bugs, the most insidious of which appear only with unique combinations of data or events.
- To demonstrate that functionality of the system appears to be working properly and performance requirements appear to be met.

- To do the component testing and integration testing.

7.3 TEST CASE DESIGN

Any system can be tested using one of three types of test case design. They are Ad Hoc testing, White-Box testing and Black-Box testing.

7.3.1 AD HOC TESTING

Ad Hoc or ad lib testing means simply examine the functionality units, trying whatever possible in attempt to make the system fail. This type of testing approach is a fast and efficient way of debugging code errors during the early development stage. During this stage of testing, NetRadio system has found many errors that could be solved. The disadvantage of Ad Hoc testing is that it usually finds many errors and never be sure what are or what are not to be tested.

7.3.2 WHITE-BOX TESTING

White-box testing is carried out at the early stage of the testing process. It is performed to ensure that the internal operation of a system performs according to specifications and all internal components have been adequately exercised. Using these methods, a system engineer can derive cases that:

- Guarantee that all independent paths within a model have been exercised at least once.
- Exercise all logical decisions on their true and false sides.
- Execute all loops at their boundaries and within their operational bounds.
- Exercise internal data structures to assure their validity.

7.3.3 BLACK-BOX TESTING

Functional or Black-Box testing is an approach to testing where the test is derived from the program or component specification. This testing is conducted to demonstrate that each is fully operational, at the same time searching for errors in each function. This testing approval enables a system engineer to derive sets of input conditions that will fully exercise all functional requirements for a program. Black-Box testing is not an alternative to White-Box testing. Rather it is a complementary approach that is likely to uncover a different class or errors than those uncovered by White-Box methods.

7.4 TESTING STRATEGIES

Testing strategies used for testing are unit testing, module testing, integration testing and system testing.

7.4.1 UNIT TESTING

Unit testing concentrates on the smallest component of the system for testing. Every individual components developed in a system are tested independently without other system components, to ensure that they operate correctly. These components might be performing tasks such as checking the ability of unicast stream within network, checking the quality and performance of the stream, checking the connection of database server and etc.

- **Unicast Streaming Testing**

The purpose of streaming testing was wanted to determine either all unicast stream could reach within network. In order to implement the testing, every lab in Faculty of Computer Science and Information Technology were chosen as the testing platform.

Windows Media Player (WMP) is the testing tool in implement this testing. WMP was used to receive any unicast streaming, which available for NetRadio system.

The quality of the stream was also evaluated during this testing. In addition, the performance, which was the time need to receive and start playing the stream was also include in this testing process.

- **Database Connection Testing**

The purpose of database testing was to make sure data could retrieve from data store. Performance and correctness for the database to make a connection and retrieve data was the key feature in this testing. Same as streaming testing, database connection testing was carried out in other network. Web browser was the testing tool for testing database connection.

To test the accuracy of the data retrieve from the database, song name was type in the box provided in the web page. After that, the data return from the query was check for the correctness and the linking provided could be function. Performance of the database connection base on the time needed for retrieves data.

- **Interface Testing**

In the NetRadio system, the interface plays an important role in ensuring that the users are able to navigate and interact with the system. The interface is tested for user-friendliness. This is accomplished by asking some users to test out the interface.

The testing performed by observing users reaction while users navigate and using the system. Later evaluation was made to determine the level of user-friendliness base on user feedback and total time consume for users to understand the function provided. This will also enlighten the problems associated with the interface.

7.4.2 MODULE TESTING

Module testing involves integrating all the interfaces in the NetRadio system into a main interface to ensure that all components can be functional and interacts with each other correctly. This testing was carried out by checking all hyperlinks on each page are functional properly to ensure that the path provided is legitimate. Interactions between one page and another are also tested to ensure that the information provided is display correctly to client.

At this time, an isolated performance test was also carried out on the broadcasting module in NetRadio system. This test was to ensure that the Windows Media Player, which embedded in the web page could provide to services for client to receive unicast stream. For example, when a user click on the songs, the Windows Media Player embedded in the web page should be able to connect to broadcast server to retrieve the stream that user had selected. The performance test was base on the time taken for buffering and plays the stream. The time taken should be in a reasonable range, which was in between 15 to 25 seconds.

7.4.3 INTEGRATION TESTING

When all modules were tested and satisfied the requirements, they were integrated into the whole system. During the integration, integration testing was carried out in order to

ensure the components of the system would support each other. The objectives of integration testing were as following:

- Compare the whole system with the functional and non-functional requirement.
- Detect any fault or bugs in the integrated system.
- Exam the correct flow of the integrated system.

The development of the NetRadio system is divided into modules and then all the modules are integrated as one main system. Therefore the bottom up approach is the most suitable integration testing method.

At the beginning of the NetRadio system integration testing, all the modules are added to the main interface. After that, try to access each module from the main interface. If there were no errors occur, the testing proceeds by switching from one module to another module. This is done by using the Ad Hoc technique.

During integration testing, if errors appear then the module that goes wrong is identified. The input and output values that cause the errors are used in module testing after the particular module is amend.

7.4.4 SYSTEM TESTING

After the integration testing, a final overall system testing is carried out. This test covers the performance, reliability, accuracy and other criteria. A testing team, which consist the developer and two users are required to carry out the system testing.

First, the team member will access the system from different network at the same time. This will determine its ability of the system to support concurrent users to access the resources of the system. Next, the two users were asked to test the system without any instruction or guideline from the developer to determine the level of user-friendliness of the system. Any errors occur during the testing process will jot down and the developer will try to solve the errors.

7.5 CHAPTER SUMMARY

There are plenty of methods and techniques that could be used to test and developed system. Testing a system is not merely for fault searching but also includes the investigation for system reliability, availability and maintainability. In the testing phase of NetRadio system, multiple ways are to ensure that the system performs well during and after delivery. However, an error-free or fault-free system is rare, not all faults and errors are able to be discovered in a short period of testing. For a stable and trustworthy system, continues testing and maintenance are required. Due to the limitation of time, the testing of NetRadio system are carried out to ensure that most of the faults and errors are absent during implementation.

In the next chapter, the system evaluation will be discussed.

SYSTEM EVALUATION

CHAPTER 8

SYSTEM EVALUATION

8.1 OVERVIEW

System evaluation is the process of accessing the usability of a system and checking that it meets user requirements. Therefore, it is part of the normal verification and validation process for software systems.

This chapter discusses an evaluation that was conducted against usability specification. The evaluation was based on the problems encountered while building the system. In addition, system strengths, system constraints, future enhancement, knowledge and experiences gained were also discussed.

8.2 NETRADIO ACHIEVEMENT

This section will discuss about the successful achievement of the project. The success of the achievement was base on the requirement of this system.

8.2.1 UNICAST SERVICE

This system had the ability to provide unicast streaming service for on-demand radio broadcasting to computer users through LAN. In conserving network resources, the maximum bandwidth for on-demand streams was set to maximum 56kbps.

8.2.2 INFORMATIVE SERVICES

As an informative system, this system does provide extra linking to other website such as Era.fm and-Hitz.fm. Brief description about those extra linking was also provided for the user to make a better choice, which can fit their needs.

8.3 SYSTEM EVALUATION

Evaluation is an important phase in development of any project as it allows one to review the overall system in many aspects. This will provide the opportunity for improving the skill and knowledge for the future development of the project. The evaluation of the NetRadio system is stated in the following section.

8.3.1 STRENGTH

This system although does not have powerful features to some extent, still has some strength of its own.

- **High Scalability**

The NetRadio system is highly scalable. The system has scalability in which it is possible to add more hardware and software easily to the NetRadio in future.

- **Wide-Accessibility**

The NetRadio system is deployable on the LAN within Faculty of Computer Science and Information Technology. This has provided wide-accessibility to users in that users can access the NetRadio virtually from everywhere. Client side software only required the installation of web browser and Windows Media Player to access the stream.

- **Interactive System**

The ability of Windows Media Services to provide unicast function has made the system become an interactive system. With unicast stream, users have the right to control the stream. Users can pause, fast forward, backward, jump to next or previous track of that

stream. Interactive also provided in the sense of this system allow users to contact with either radio station such as Era.fm and Hitz.fm.

8.3.2 LIMITATION

Despite some of the system strengths mentioned previously, there are limitations which cannot be handling and researched.

- **Limited Selection of NetRadio Program**

The selection of radio channel is only limited to local radio programs only for example Era.fm and Hitz.fm. The songs provided are limited to few songs only because this system to build is to show ability of the streaming audio over IP network using streaming technology only. Copyright issue is also one of the boundaries of this system.

- **Version of Windows Media Player Dependent**

The version of Windows Media Player in the client side will affect the performance of NetRadio in streaming audio files to client. If the version is not compatible, client will required downloading codec from Microsoft websites before receive the stream. This will delay users from receive the stream directly from the broadcast server on time. The appropriate version requires for listening audio files was 6.4 or later.

- **Requirement For Broadband Connection**

For the live radio streaming required broadband connection from the client side, which require about 250kbps in order to access the live streaming. This range of bandwidth is necessary in order to provide a good quality for client. As a result, the live stream is unable to receive by Internet users because this range of bandwidth does not provide by local Internet Service Provider (ISP) for normal Internet users.

8.4 PROBLEMS ENCOUNTERED

Along the process of completing this project, a lot of problems surfaced from time to time. These problems usually involved the using of technologies and new products such as ASP, Windows NT server, IIS, Windows Media Services and Access server.

8.4.1 SETTING UP SERVER

Many problems are faced in setting up the relevant server in the NetRadio such as Access server, Windows Media Services server and Windows NT server. This problem is due to lack of experience in dealing with the server. For the streaming server, Windows Media Services 4.0 is not compatible with Windows XP. As an alternative, Windows NT server was chosen as the operating system for NetRadio.

8.4.2 UNFAMILIARITY WITH NEW TECHNOLOGY

Streaming technology is still new to be computing world. Problem is faced in understanding the concept and implementing the new technology to develop the system such as system architecture design to enhance the performance and usability of the system. In addition, the requirement to convert audio file to Active Streaming Format was also one of the problem encountered. The suitable converter was difficult to determine.

8.5 SOLUTION

The two problems discuss above, was solved after reading products documentation, which provided along the product.

8.6 FUTURE ENHANCEMENTS

In order to improve upon the current developed system, a few enhancement or new features could be added.

8.6.1 INTEGRATED WITH EXTRA INFORMATION

The current NetRadio system did not display any information about the current and next stream of media files. It will be more informative if the stream information is built into the database. The client who wants to know more detail about the stream provided can browse from that particular stream information and has a better understanding of what will be display about the current and next streaming provided to client.

8.6.2 SYNCHRONIZE SONG WITH LYRICS

To make the system become more attractive, song's lyrics can be added into the system and synchronize with the song. This will enable users not only limited to listen to the song, they can also read the lyrics provided from the system while the song is playing.

8.7 KNOWLEDGE GAINED

There is a lot of knowledge gained after the completion this project. This type of knowledge was very useful in build up our career in the future time.

8.7.1 UNDERSTANDING OF STREAMING TECHNOLOGY

Streaming technology is something new in computer world. Windows Media Services has provided a good platform in understanding the streaming technology. With the excellent documentation provided, the concept of the streaming technology was gained. In addition, to that, it also provided better understanding in unicast stream. Although streaming technology is still new, the potential of technology is very strong. An understanding in this technology was an additional competitive advantage.

8.7.2 USING ACCESS SERVER

Microsoft Access server is designed for the use over the any network. As such, the Microsoft Access server will be an interesting business solution to distributed organizations. In the sense, knowledge on the feature and functionality of the Access server is of great value.

8.7.3 IMPROVE DEBUGGING SKILL

ASP does not provide debugging function. Without the reliance on automated debugging tools, other debugging methods have to be used such as displaying message boxes and printing values of variables onto the page. This has provided an opportunity to improve debugging skill.

8.8 CHAPTER SUMMARY

In overall, the initial objectives set by the project have been achieved. This project has successfully created an informative, innovative, interactive and user-friendly web base system for Faculty of Computer Science and Information Technology. In addition, the system has the ability of implement on-demand streaming of radio program using unicast technology through LAN. The successful of the creation of low bandwidth audio files enable the on-demand services provided would not consume much network bandwidth.

In next chapter, the summarization will be discussed. It contains the summarization from Chapter 1 until Chapter 8.

CONCLUSION

CHAPTER 9

CONCLUSION

Overall, this project has successfully delivered the system on tie and fulfilled the objectives and requirements as determined during system analysis phase. This system allows users to listen online radio programs using their personal computer.

In addition, to make this system more attractive, on-demand services also provided to users. Users can select the song from the database on-demand. As an informative and interactive system, this system does provide some useful link to other websites and also provides mailing services for users to contact the administrator.

This project has provided the golden opportunity to learn the fundamental of database programming while at the same time, gain knowledge of Microsoft technology such as Windows Media Services, Access server, Windows NT and IIS. In addition, it also provides the opportunity to expose to hardware technology throughout this project. Thus, the knowledge gained during this project is priceless.

NetRadio project is an innovative and groundbreaking concept, which deploys the multimedia and streaming technology in a web base system to provide information to computer users. The success of this project will introduce a new way to listen radio program to Internet users.

REFERENCES

REFERENCES

Web Sites:

http://computer.howstuffworks.com/internet-radio.htm [Data Retrieved: 30 March 2004]

http://www.radideo.com/webcast/webservers.htm [Data Retrieved: 30 March 2004]

http://dvrplayer.com [Data Retrieved: 30 March 2004]

http://www.microsoft.com [Data Retrieved: 5 April 2004]

http://www.apacheweek.com/features/apache [Data Retrieved: 5 April 2004]

http://radio.mmu.edu/my/ [Data Retrieved: 10 April 2004]

http://www.era.fm/ [Data Retrieved: 10 April 2004]

http://www.hitz.fm/ [Data Retrieved: 10 April 2004]

http://www.web-radio-book/casestudies.html [Data Retrieved: 18 April 2004]

http://www.radideo.com [Data Retrieved: 18 April 2004]

http://www.eham.net/newham/images/typical.gif [Data Retrieved: 30 April 2004]

http://www.streamingmedia.com/article [Data Retrieved: 7 May 2004]

http://www.anetstation.com/webradiobasics.htm [Data Retrieved: 7 May 2004]

http://www.pcquest.com/content/search/showarticle [Data Retrieved: 7 May 2004]

http://streammedialand.com/streamingoverview.pdf [Data Retrieved: 15 May 2004]

http://www.microsoft.com/windows/windowsmedia/ [Data Retrieved: 28 August 2004]

Books:

1. Ian Sommerville (2001). *Software Engineering 6th Edition*. United State of America: Addison Wesley.

2. Pamela Rice Hahn. How to Use Microsoft Access 2000. Federal Publications.

GLOSSARY

GLOSSARY

A—B

Access control list (ACL) checking

A part of Microsoft Windows security that Windows Media Services uses to verify that a client has permission to access a particular file or directory. Using ACL checking, a system administrator can set permission restrictions on an .asf file and on directories.

ActiveX

A Microsoft technology that enables different programs to share information. ActiveX extends Microsoft Windows-based architecture to include Internet and corporate intranet features and capabilities. Developers use it to build user interactivity into programs and World Wide Web pages.

ActiveX controls

Controls that use ActiveX technology. These controls can be downloaded automatically from a Web page and executed by a Web browser.

Advanced Streaming Format (ASF)

A data format for streaming audio and video content, images, and script commands in packets over a network. ASF content can be an .asf file or a live stream generated by Windows Media Encoder. ASF content that is in the process of being delivered over a network is called an *ASF stream*.

Advanced Streaming Format (.asf) file

An audio or video file that is formatted in ASF.

Alias

A name that is substituted for a URL. For example, when creating a station, you can use an alias to specify the information that defines the connection between the Windows Media server components and Windows Media Encoder. For example, Stream1 is the alias for the URL, msbd://server:port. When you are creating a station, you can type **Stream1** in the **Alias** dialog box. The server components resolve this alias by checking it against the definition on the encoder. The benefit of using aliases is that you do not have to remember constantly changing URLs. As long as you know the alias name, the URL can be resolved correctly.

Announcement

A simple .asx file that contains information about the URL for a stream. Announcement files are created by Windows Media Administrator when a unicast publishing point or multicast station is created. The client quickly loads the announcement file, then opens the ASF stream in the unicast publishing point or extracts the URL to the ASF stream from an .nsc file and plays a program at the multicast station.

ASFCheck

A command-line utility for detecting and fixing some of the problems that are commonly found in ASF version 1.0 files.

ASFChop

A command-line utility for trimming the beginning or end of an ASF stream that has been stored by Windows Media Encoder.

ASF Stream Descriptor (.asd) file

A configuration file created and read by Windows Media Encoder. The file contains Encoder settings that describe the characteristics of a multimedia stream. The file also is read by the Windows Media Station service to define the stream format supported by a given station.

ASF Stream Redirector (.asx) file

An ASX metafile that provides information that Microsoft Windows Media Player uses to receive unicast streams, multicast streams, and other supported media from an intranet or the Internet. These files are loaded quickly by Windows Media Player and contain information for the following purposes:

- To transfer control from the HTTP browser to the Windows Media Player control so that streams can be directed to Windows Media Player.
- To provide an announcement that Windows Media Player can use to access a program on a Windows Media station.
- To provide references to streams and the rules for protocol rollover that Windows Media Player uses to process them.
- To provide a playlist that defines the order in which streams are streamed to Windows Media Player.

ASX3Test

A command-line utility for verifying the syntax of .asx files that have been created manually.

attribute

In an .asx file, a qualifier that describes a property of an ASX element. For example, an .asx file can include the element **Repeat** that contains the attribute Count. This particular element and attribute define the number of times the client repeats the playback of the piece of content or the playlist.

Audio Compression Manager (ACM)

A device driver manger that controls which applications are required to play or record sounds. The ACM manages the following types of drivers:

- Compressor and decompressor (codec) drivers
- Format converter drivers
- Filter drivers

If a source file was created on a non-Windows computer, it may not use an ACM codec and thus can not be used by Windows Media Technologies.

authentication

The process of verifying logon information for a client. A Windows Media server can be set to authenticate clients before they are given access to ASF content or streams.

authorization

The process of granting or denying access permissions to clients. A Windows Media server can be set to authorize client requests for ASF content.

bandwidth

The amount of data that can be transmitted in a fixed amount of time. On computer networks, higher bandwidth indicates faster data transfer. Network bandwidth is expressed in bits per second (bps).

In the Windows Media Services environment, Windows Media Administrator can specify bandwidth constraints for a variety of functions, including maximum aggregate bandwidth unicast from a server, maximum bandwidth for a single unicast stream from a server, and continuous bandwidth used by a multicast file transfer from a server.

bit rate

The speed at which binary content can be streamed across a network. It usually is measured in kilobits per second (Kbps)—for example, 28.8 Kbps. Windows Media Encoder and Windows Media Administrator have settings for the bit rate of ASF content.

broadcast

Describes how a client experiences receiving a stream. A broadcast stream can be *multicast* or *unicast*. In a broadcast connection, the client is passive and does not control when the stream starts or stops. In contrast, in an on-demand connection, the client is active and controls when the stream is started or stopped.

broadcast multicast

Delivery of one stream by a Windows Media server to many clients, which *listen* to it by monitoring the IP address over which the stream is multicast. From the

client perspective, a broadcast multicast is a connectionless experience because the client never connects to a Windows Media server.

broadcast unicast

A point-to-point connection that a client initiates to a publishing point on a Windows Media server.

buffer

An area of memory reserved for use as an intermediate repository in which data is temporarily held while waiting to be transferred between two locations. A buffer ensures that there is an uninterrupted flow of data between computers.

C—H

Caption

A feature that sends a Synchronized Accessible Media Interchange (SAMI) file (a file in closed-caption format) with an ASF stream. Captioning is an accessibility feature that displays captions along with the video and audio, much like the closed-captioning that accompanies some television programs. It also can be used to display subtitles in a foreign language.

client

Typically, the software that makes requests in client/server communications. Client software requests connections and communicates with servers.

codec

Short for compressor/decompressor. An algorithm or scheme used when recording digital video or audio. A codec is used, for example, when video is

transmitted over the Internet; the video is compressed on the sending end and decompressed on the receiving end. Windows Media Tools provides a choice of codecs for ASF content. Users can select a codec based on the audio or image quality, and image size preferred.

content

Data that servers stream to a client or clients via unicast or multicast. Content can originate from live audio or live video presentation, stored audio or video files, still images, or slide shows. The content needs to be transformed from its original state into ASF in order for a server to stream it. Windows Media servers can stream live ASF streams or stored .asf files as content.

destination address

An IP address and port, from which a listening client can receive a multicast. A client instructs its network card to listen for packets arriving at the destination address and port.

distributed Component Object Model (DCOM)

An extension of the Component Object Model (COM). DCOM enables software components to communicate directly with each other across networks, including the Internet and intranets, in a reliable, secure, and efficient manner.

distribution

Delivering an ASF stream from one server to another. Distribution serves many purposes, such as:

- Distributing a stream to another server, which then unicasts the stream, allowing clients in a part of the network that is not enabled for multicasts to receive the stream.
- Distributing a stream to a server that is enabled for HTTP streaming. This allows users behind a firewall to receive a stream that they otherwise would not be able to receive.
- Distributing a stream from one Windows Media server to another Windows Media server, in order to create more unicast streams. For example, if you have reached the maximum number of unicast streams for a server, you can send a stream to another server, which then can unicast that stream to more clients.

distribution mode

A setting of Windows Media server components that indicates whether Windows Media server components are going to multicast the ASF stream, distribute the ASF stream (via unicast), or do both. If the distribution mode is set to multicast only, then the server broadcasts the ASF stream via multicast and unicast. If the distribution mode is set to distribution only, then the server delivers the ASF stream if requested by another server that is going to broadcast the ASF stream. If the distribution mode is set to both, then the multicast mode and the distribution mode are functional.

element

In an .asx file, an entity that defines a particular setting or action to the client. Elements can be modified by attributes. For example, a **ref** element has attributes that define the URL that points to particular content.

error correction

A method for controlling data transfer errors in a unidirectional communication system. Extra information is sent, along with the data, that the receiver uses to check and correct the data.

Error Correction Code (ECC)

The method of error correction used in an earlier version of Windows Media Services. Redundant data is sent with the data stream to detect and control single bit errors in the data stream. In the current version of Windows Media Services, streaming errors are corrected through UDP resend.

File Transfer service (FTS)

A feature of Windows Media Services that multicasts files over a network to an ActiveX control (Nsfile.ocx) on a client computer.

firewall

A system or combination of systems that enforces a boundary between two or more networks, and keeps unauthorized users out of private networks. A firewall system checks all incoming and outgoing messages to make sure they meet predetermined security criteria.

frame

One static image of many sequential images that make up a video title.

frame rate

The speed at which individual frames change. High frame rates generally produce better quality images.

home directory

See Home publishing point.

Home publishing point

The root directory for publishing ASF content. Microsoft Windows Media Player can stream any .asf files placed in this directory or its subdirectories. A home publishing point is also an on-demand publishing point. Unlike other publishing points, a home publishing point does not have an alias. Instead, the computer name is used in a URL for access to the home publishing point. Also called the ASF root directory.

I—O

illustrated audio

A stream that combines audio content with synchronized images to make up an online slide show that runs at low bandwidths.

image color matching (ICM)

An application interface that communicates the color information of each device so that applications can accurately display, print, and pass colors on to other users and applications. Other operating systems may use different color matching schemes. Video content created using non-ICM data does not render correctly on Windows based computers.

Integrated Services Digital Network (ISDN)

A completely digital telephone/telecommunications network for carrying voice, text, images, and video traffic at high speed by sending digitally-encoded signals.

Internet Protocol address (IP address)

A 32-bit number that is the unique IP address of each computer or device on the Internet. This number specifies a physical location, or node, on the network.

Internet Server API (ISAPI)

A framework for creating a dynamic link library (DLL) to provide Internet server-side functionality. Windows Media Services uses ISAPI to provide one of the options for security.

intranet

A network belonging to an organization. Only members of that organization have access to it. An intranet that is connected to the Internet usually is protected by a firewall or other device.

listen

To monitor a specific multicast IP address. Microsoft Windows Media Player monitors a multicast IP address for data that is being streamed from a server.

local

Close at hand or restricted to a particular area. In communications, a local device is one that can be accessed directly rather than by means of a communications link. In information processing, a local operation is one performed by the computer at hand rather than by a remote computer. For example, the server

computer on which Windows Media Services is installed is the local computer with respect to that server.

log

To collect and store data about Windows Media Services events. Windows Media Administrator can log information about unicasts, multicasts, and clients.

marker

A pointer to a specific place, measured in time, in an .asf file. Microsoft Windows Media Player uses markers to go directly to a point in an .asf file. Markers in an .asf file allow viewers to skip ahead to a marker or skip back to a previous marker in order to see a particular part of the .asf file again.

Media Stream Broadcast Distribution protocol (MSBD protocol)

A protocol used to reference a Windows Media Encoder, which is the source of a stream, such as **msbd://***server_name*. It also is used when streaming from the Windows Media Station service to a content-storage server. In addition it is used for server to server distribution.

metadata

In a Windows Media Technologies system, information about content, such as the title, author or copyright. The information is contained in an .asx file.

metafile

In a Windows Media Technologies system, a text file that contains information, for media content. Windows Media Services use three kinds of metafiles: .asd file metafiles, .asx file metafiles, and .nsc file metafiles.

Microsoft Internet Explorer

A Windows-based Web browser produced by Microsoft Corporation. Microsoft Internet Explorer version 5 is used by Windows Media Services in several ways. For example, Windows Media Administrator uses Internet Explorer to display its Web pages. Content creators can embed the Microsoft Windows Media Player ActiveX control in an HTML page that is viewed with Internet Explorer.

Microsoft Media Server protocol (MMS protocol)

A protocol used to reference and stream .asf files from a Windows Media server.

Microsoft Windows Media Player

A client program or control that receives streaming media from a Windows Media server. This control either can run as a stand-alone client executable program or can be embedded in a Web page, C++ program, or a Microsoft Visual Basic program that uses the client ActiveX control. Microsoft Windows Media Player is the first version that is a universal player.

multicast

A one-to-many connection in which multiple clients can receive the same stream from a server. To receive a multicast, a client must have access to a multicast-enabled network. In contrast, a unicast is a one-to-one connection in which one client receives a distinct stream from a server.

multicast-enabled network

A network that has routers that can interpret Class D IP addresses.

multiple bit rate video

A feature of Windows Media Technologies that supports the creating and streaming of six encoded video streams within one ASF stream. Using multiple bit rate video in Windows Media Encoder creates ASF content that has a variety of video streams at variable bandwidths for either low or high bandwidth target audiences. When creating multiple bit rate content for low bandwidth audiences, the video streams can range from 18 Kbps to 300 Kbps. Alternatively, high bandwidth target audiences include video streams that range from 81 Kbps to 10 Mbps. Both target audiences include a separate encoded audio stream. When encoding multiple bit rate video, an additional insurance video stream is also encoded that is based on a percentage of the lowest selected bandwidth. After receiving this multiple encoded stream, the server determines which bandwidth to stream based on the network bandwidth available. Multiple bit rate video is not supported on generic HTTP servers.

.ocx

Frequently used as a synonym for an ActiveX control, .ocx is the file name extension for a control.

on-demand

Describes stored media content that is available for streaming on a Windows Media Services system. Windows Media Services can stream either stored content from a publishing point, or live content using Windows Media Encoder.

on-demand unicast

A point-to-point connection that a client initiates to a publishing point. In an on-demand unicast, the server streams stored content to the user.

P—T

packet

A unit of data transmitted over a network. A packet is of fixed size, and is routed between a source and a destination. It contains binary information that represents both data and a header containing an ID number, source address, and destination address.

padding

Empty space that is appended to individual packets in a content stream to keep packet size constant. Windows Media Services supports variable packet length. However, Windows Media Encoder limits packets to a fixed length to ensure compatibility with earlier versions of Windows Media Services.

payload

A data unit that contains one or many stream data objects.

player

A client program or control that receives content streamed from a Windows Media server. Throughout the online Help, this refers to Microsoft Windows Media Player.

playlist

A list of streams that Microsoft Windows Media Player plays sequentially. Windows Media Services supports both server-side and client-side playlists.

- A server-side playlist is played as part of a program over a station. You use the **Streams** button on the Stations page of Windows Media Administrator to create the playlist. A server-side playlist can include URLs that point to streams, including .asf files.
- A client-side playlist is an .asx file that contains multiple Entry elements. Windows Media Player plays the Entry elements in the order in which they appear in the .asx file.

port

A location on a server from which content streams to a client. A port is represented by a number that is part of a URL. Windows Media server components, when in use, bind to ports. By default, the Windows Media Unicast service binds to port 1755 and the Windows Media Station service binds to port 7007. If HTTP streaming is enabled for a service, then that service switches to use port 80, which is the preferred port for any HTTP streaming. You can change the ports that any of the Windows Media server components use by editing the registry.

program

One or more streams that Windows Media server components manage as a single entity. The program can be thought of as a container holding streams.

property

A characteristic of an object, such as a stream. For example, Windows Media Encoder displays stream properties, such as the bandwidth and the codec used, on a properties page.

protocol

A set of formats and procedures that enable computers to exchange information. Protocols that Windows Media Services use include HTTP, MMS, and MSBD.

protocol rollover

A procedure that allows switching from one protocol to another when a Windows Media server fails to make a connection using a particular protocol. For example, if a client uses MMS protocol to request ASF content, the server attempts to stream the ASF content using UDP. If that protocol fails, then the server attempts to stream the content using TCP, and then if that fails, the server attempts to use HTTP, if it has been enabled. Protocol rollover is not utilized if either MMSU protocol (MMS over UDP) or MMST protocol (MMS over TCP) is used to request ASF content.

proxy server

A server computer that controls Web-based traffic between local area networks and the Internet or other intranets.

publishing point

A virtual directory used for storing content that is available to clients, or for accessing a live stream. Clients reach a publishing point through its URL.

Publishing Point Events Monitor

A tool that monitors and displays server unicast events. Specifically, the Publishing Point Events Monitor displays unicast server (publishing point) event activities.

QuickStart

A group of wizards in Windows Media Technologies that are used for such tasks as configuring Windows Media Encoder and creating stations or publishing points.

remote

Not in the immediate vicinity or not directly accessible. A computer or other device located in another place (room, building, or city) and accessible through some type of communications link. For example, Windows Media Administrator can be run on a computer (a *remote* computer) other than the Windows Media server, so that a *remote* administrator can administer the server. Windows Media Encoder also can be run from a remote computer.

router

A device that connects two or more networks, and carries data forward. A router determines where the destination computer is located, and then finds the best way to transmit the data there.

scope

In multicasting, the reach of a stream. Windows Media Administrator enables the user to define the scope of a multicast. The scope of a multicast stream can be set

to reach only an immediate subnetwork, or it can be set to reach the entire Internet. Scope is also equal to time-to-live (TTL).

script commands

Special instructions that are included in ASF data streams and delivered to the client. Microsoft Windows Media Player passes script commands to a device or an application that interprets them. Script commands are used for such tasks as calling specific files or navigating to a specific Web site.

security

The process of controlling access to resources based on user credentials and permissions. In a Windows Media Services environment, security means restricting and controlling access to Windows Media server components, Windows Media Administrator, and Windows Media content, both stored and streamed. Windows Media Services has built-in security mechanisms that integrate with Microsoft NTLM. Windows Media Services supports both server-side and client-side authentication.

station

A defined location from which a player can receive streams. In effect, it is an IP address and a port. Windows Media server components use stations with ASF streams only, and save station information as a file with an .nsc extension.

stream

Data transmitted across a network and any properties associated with the data. Streaming data allows the player to begin rendering the data immediately instead of waiting for the entire file to be downloaded.

stream data object

Data that represents an individual data type within the ASF stream, for example, a compressed video frame.

stream format

Information about the correct settings necessary for a player to render a stream properly. This information contains such settings as the bit rate, the size of the image, and the codec. Stream formats can be template stream formats or custom stream formats. Stream formats are contained in .nsc, .asd, and .asf files.

template stream format (TSF)

In Windows Media Technologies, a predefined group of settings that match content type and bit rate with appropriate audio and video codecs. Windows Media Encoder uses this feature to assist the user in quickly configuring the encoder to create ASF content.

time-to-live (TTL)

In multicasting, a value that defines the number of routers through which a multicast can pass before a router stops forwarding the multicast. TTL is equivalent to scope.

U—Z

unicast

A client/server connection in which a client receives an on-demand stream of stored content from a server, or receives a broadcast of live content. No other

client has access to this stream. In contrast, a single multicast stream is available to multiple clients.

unicast rollover

A procedure that Microsoft Windows Media Player follows if it cannot receive a multicast from a station on a Windows Media server. Windows Media Player sometimes cannot receive a multicast for several reasons, including the absence of multicast-enabled routers on the network. If Windows Media Player cannot receive the multicast, it uses the unicast rollover URL contained in the .nsc file to connect to a server and request a unicast of the stream.

Universal Naming Convention (UNC)

Also called Uniform Naming Convention. A convention for specifying directories, servers, and other resources on a network, using two slashes // or backslashes \\ to indicate the name of the computer, and one slash to indicate path or directory levels within the computer, in this format: *computer**directory*.

URL flips

A set of instructions to the browser to change the content being displayed on a Web page, regardless of the state of the display. This is what enables the user to link from one page to another without waiting for the content on the first page to be completely rendered.

URL rollover

A rollover method used to specify different Windows Media servers that contain the same content. For example, if the first REF tag in a .asx file specifies an .asf file on a server called *hound1* and the second REF tag specifies a copy of the file

on *hound2*, Windows Media Player can reach the file using either server. If *hound1* is too busy or fails, Windows Media Player automatically connects to *hound2*.

User Datagram Protocol (UDP)

A connectionless transport protocol in the TCP/IP protocol stack that, like TCP, runs on top of IP networks.

video capture card

An add-on board for providing digitized images on a computer. With a video capture card, you can provide live camera or VCR input to Windows Media Encoder.

VidToASF

A command-line utility that quickly converts an edited .avi or .mov file to an .asf file so that it can be stored on a Windows Media server and streamed to clients.

WavToASF

A command-line utility that quickly converts an edited .wav audio file to an .asf file so that it can be stored on a Windows Media server and streamed to clients.

Windows Media Administrator

A Web-based administrative application for monitoring real-time usage of Windows Media component services, managing content, and configuring the system.

Windows Media ASF Indexer

A Windows-based utility for deleting portions of an ASF stream that has been stored by Windows Media Encoder. You also can use Windows Media ASF Indexer to edit properties, markers, and script commands.

Windows Media Audio (.wma) file

A special type of advanced streaming format file for use with audio-only content encoded with the Windows Media Audio codec.

Windows Media Audio Redirector (.wax) file

A special type of .asx metafile for use with .wma files. The .wax file includes information about the location of the .wma file on the Windows Media server and the properties of the file.

Windows Media Author

A graphical interface tool for creating and testing illustrated audio. The tool is designed to combine and synchronize audio and image files. Using it, the author can manage objects—sounds, images, and URLs—so that they appear at the correct time during playback. This tool uses technology from Digital Renaissance, Inc.

Windows Media client

The ActiveX control called Microsoft Windows Media Player that receives and renders ASF content from Windows Media server components. The client can be on the same computer as the server, or it can be on another computer.

Windows Media component services

A set of services running on a Windows Media server. These services multicast and unicast live audio and video presentations and stored files to client computers.

Windows Media Encoder

A feature of Windows Media Technologies used to create live ASF streams. Windows Media Encoder turns live audio and video content into an ASF stream and distributes that stream through a port. Windows Media Encoder also can save an ASF stream as an .asf file. Windows Media Encoder can distribute an ASF stream via MSBD protocol or HTTP.

Windows Media Plug-in for Adobe Premiere

A utility that allows a content creator to use Adobe Premiere to produce ASF content for Windows Media Technologies.

Windows Media Presenter for Microsoft PowerPoint 97

A Windows Media Technologies feature, available from within Microsoft PowerPoint 97. It enables PowerPoint to connect to Windows Media Encoder and to send a PowerPoint presentation to a Windows Media server for distribution to client computers.

Windows Media program (.nsp) file

A file that contains information about a Windows Media Services program, used primarily in backing up and restoring Windows Media Services program definitions.

Windows Media server components

Another term for Windows Media Services, which is used to multicast and unicast live audio and video presentations and stored files to client computers. Includes

both Windows Media component services, which run on a Windows Media server and Windows Media Administrator, which is used to manage these services.

Windows Media Services

Another term for Windows Media server components, which is used to multicast and unicast live audio and video presentations and stored files to client computers. Includes both Windows Media component services, which run on a Windows Media server and Windows Media Administrator, which is used to manage these services.

Windows Media Station (.nsc) file

A file that describes a station to the player. The player accesses the station file indirectly by way of an .asx file that directs the client to a specific .nsc file.

Windows Media Monitor service

One of the Windows Media component services.

Windows Media Program service

One of the Windows Media component services.

Windows Media Station service

One of the Windows Media component services that provides multicasting, distribution, and storage functions for ASF streams. It can manage multiple stations, with each station having an ASF stream as input, and direct the stream to a multicast address, one or more distribution servers, a disk, or a combination of all three. A similar feature, Windows Media Unicast service, is available for unicasting ASF streams.

Windows Media Technologies

The family of streaming media applications that includes Windows Media Services, Windows Media Tools, and Windows Media Player. Windows Media Tools create ASF content that can be served to client computers using Windows Media Services and played with Windows Media Player.

Windows Media Tools

A set of tools that can be used to create ASF content for Windows Media Services. These tools include Windows Media Encoder, Windows Media Author, and Windows Media ASF Indexer; the conversion utilities VidToASF and WavToASF; and the file utilities ASFCheck, ASFChop, and ASX3Test.

Windows Media Unicast service

One of the Windows Media component services that provides unicasting functions for ASF streams. This service manages publishing points to which clients connect in order to receive either broadcast unicast streams or on-demand unicast streams. A similar feature, Windows Media Station service, is available for multicasting ASF streams.

APPENDIX

USER MANUAL

The purpose of this manual is to provide some helpful guideline and usage about this NetRadio system to the end user. All the procedures of this system are explained steps by steps. The user manual will be presented according to the systems module, which is based on the NetRadio system module.

Introduction

NetRadio system is developed to provide an informative and entertainment environment to the users. It is also to ensure the most reliable and the users enable to listen to the on-demand program radio and they also can make announcement to preview in the web site.

User Interface

The interface of NetRadio provides information to the users especially students and staffs of Faculty Science Computer and Information System. First column, "highlights", brought an announcement from the administrator. The column "what's new" explained the latest or new things in the web site and "activities" column is the programs or activity that have planned by the administrator of NetRadio. Above the web page, show the buttons to link to other web site. The NetRadio user interface shown as figure 1.1 below.

Figure 1: NetRadio User Interface

Radio

Once the user click to the link "Listen to NetRadio!" the Windows Media Player will appear and user have to click the play button to listen to the on-demand program. There are also some link to other web site such as Institut Kefahaman Islam, Era, Radio MMU and other. Besides that, user also can click to the image and it will go to Playlist page. On this page, there will be the mp3 songs which can be downloaded by user. User can select one of the songs that provided. Figure 2 show the Radio page where the streaming program can be listening here. Figure 3 show the Playlist page of mp3 songs.

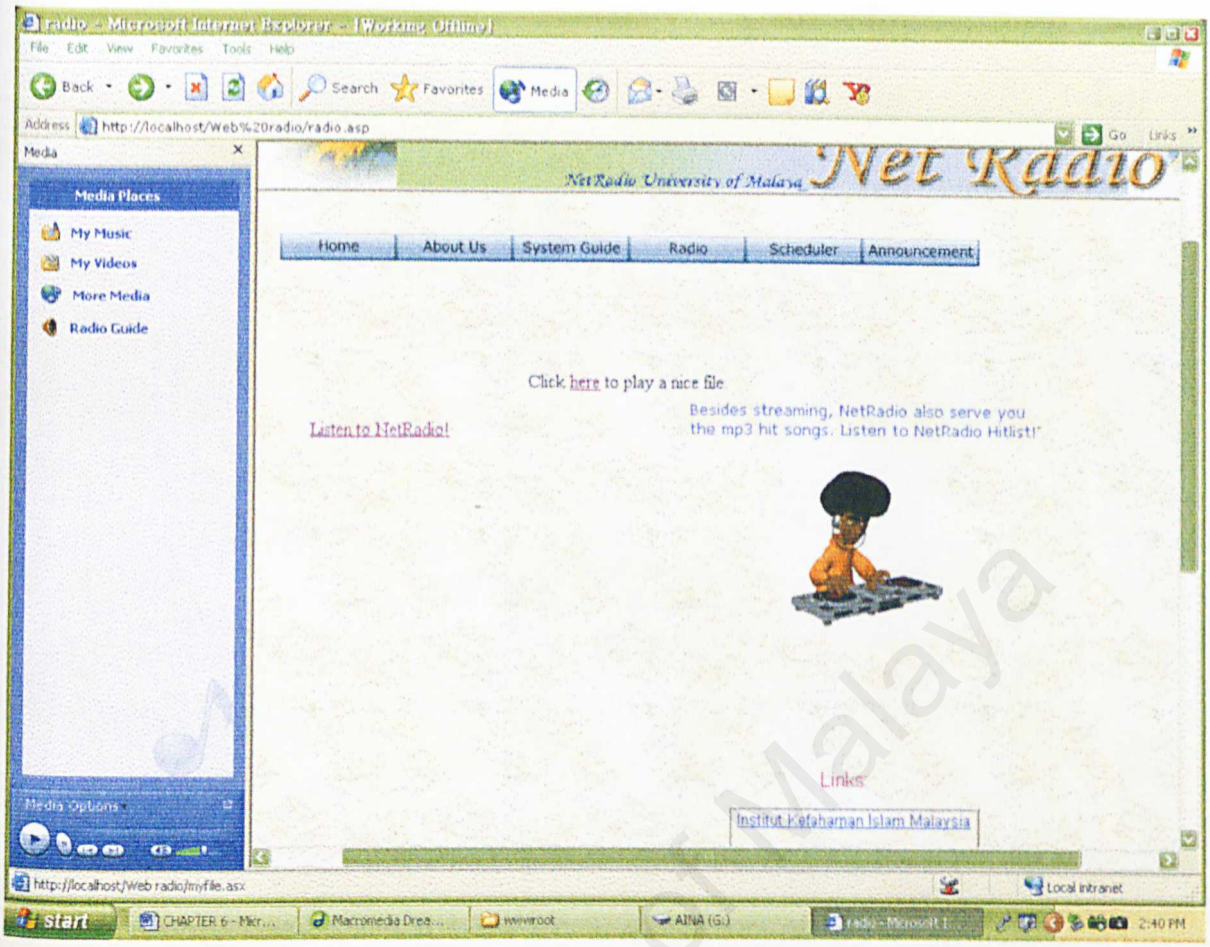

Figure 2: Radio page for listen to the streaming program

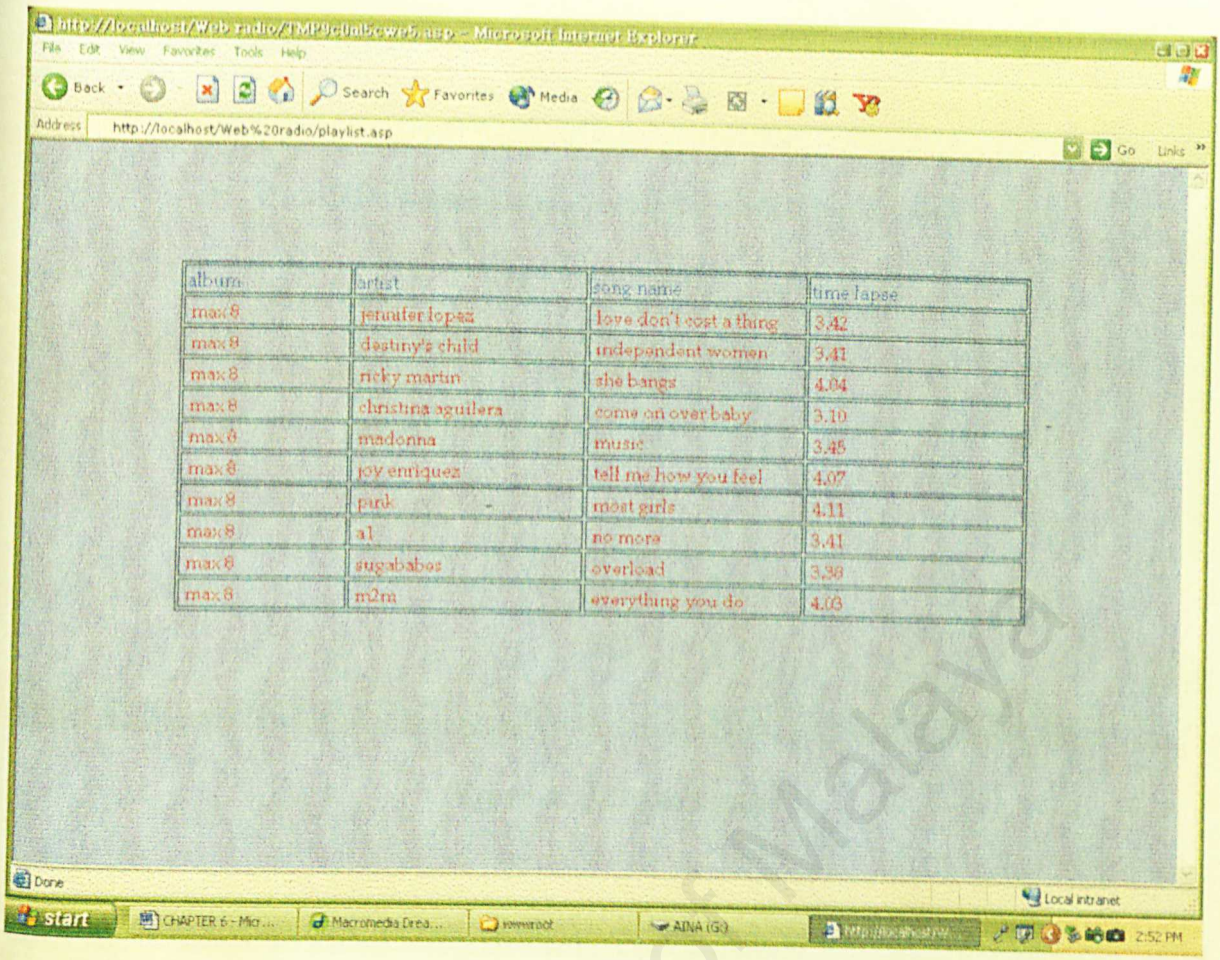

Figure 3: Playlist page to listen to mp3 songs

Schedule of NetRadio

This page will view the schedule of the program for one day. There is also "Admin Login" for administrator to see the record of the one week schedule. If the username and password entered wrongly, administrator is required to login again or back to "Home". Figure 4 below show the Schedule page. Figure 5 show the Administrator Record page.

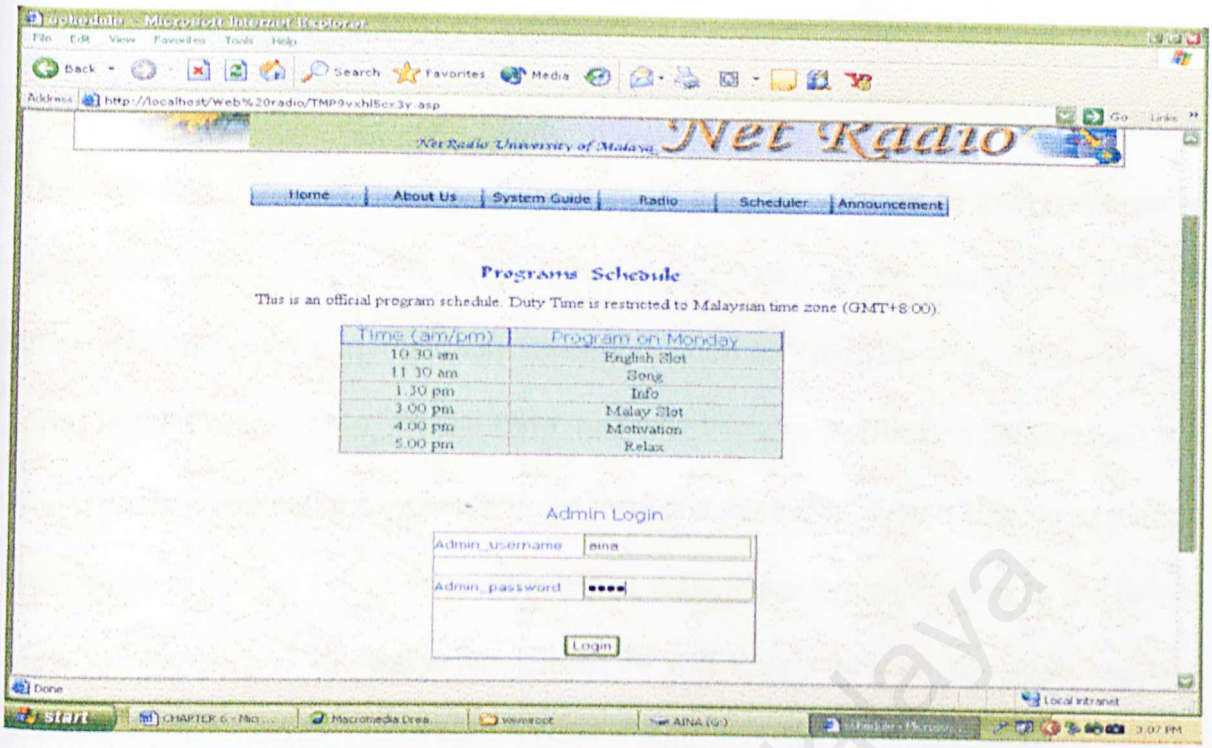

Figure 4: Schedule page

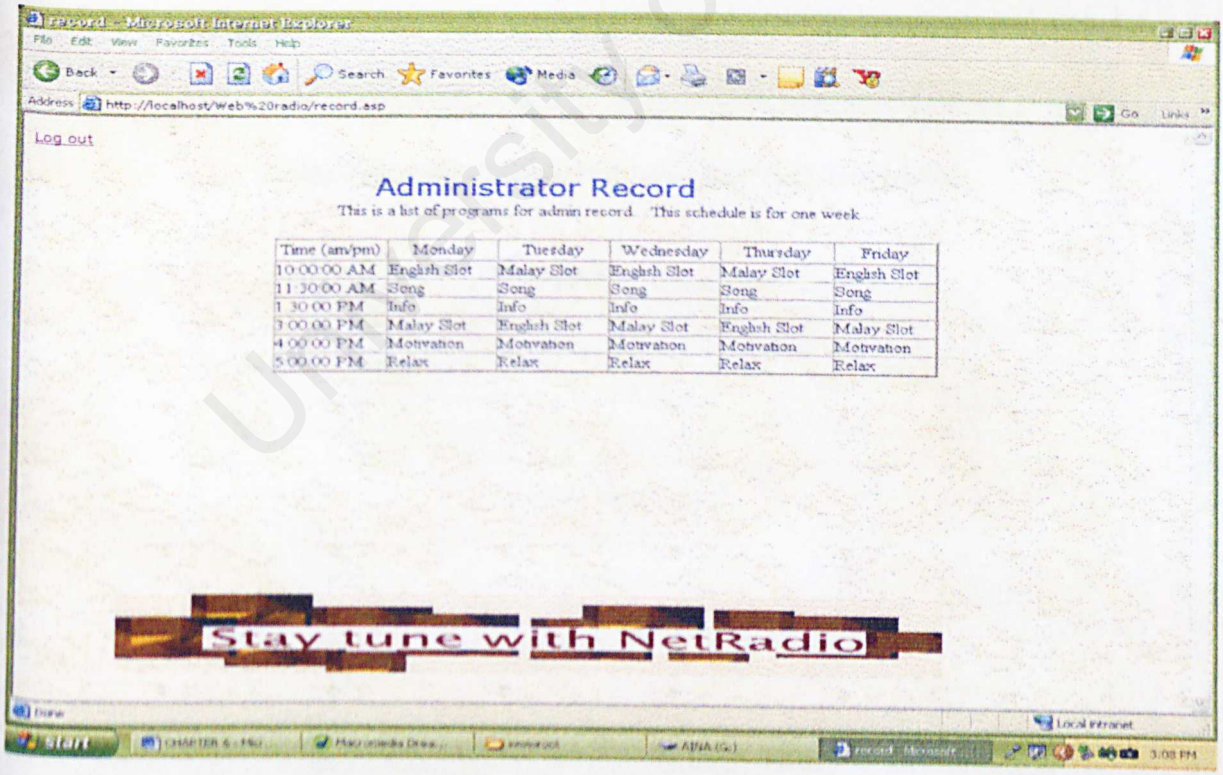

Figure 5: Administrator Record

Announcement and Comment/Suggestion

There are also forms for users to fill in to make announcement or to give comment or suggestion. User has to fill their name, email, topic to be announced and the announcement. After that, click the "Submit" button to send. Same as Announcement form, in the Comment, Suggestion form, and user has also to fill their name, email and also type the comment or suggestion in the form and click the "Submit" button to send. If user wants to see the list of announcement or comment/suggestion, click to the link to view the page. Then, the following screenshot will appear to view the page. Figure 6 below show the Announcement page. Figure 7 show the list of announcement.

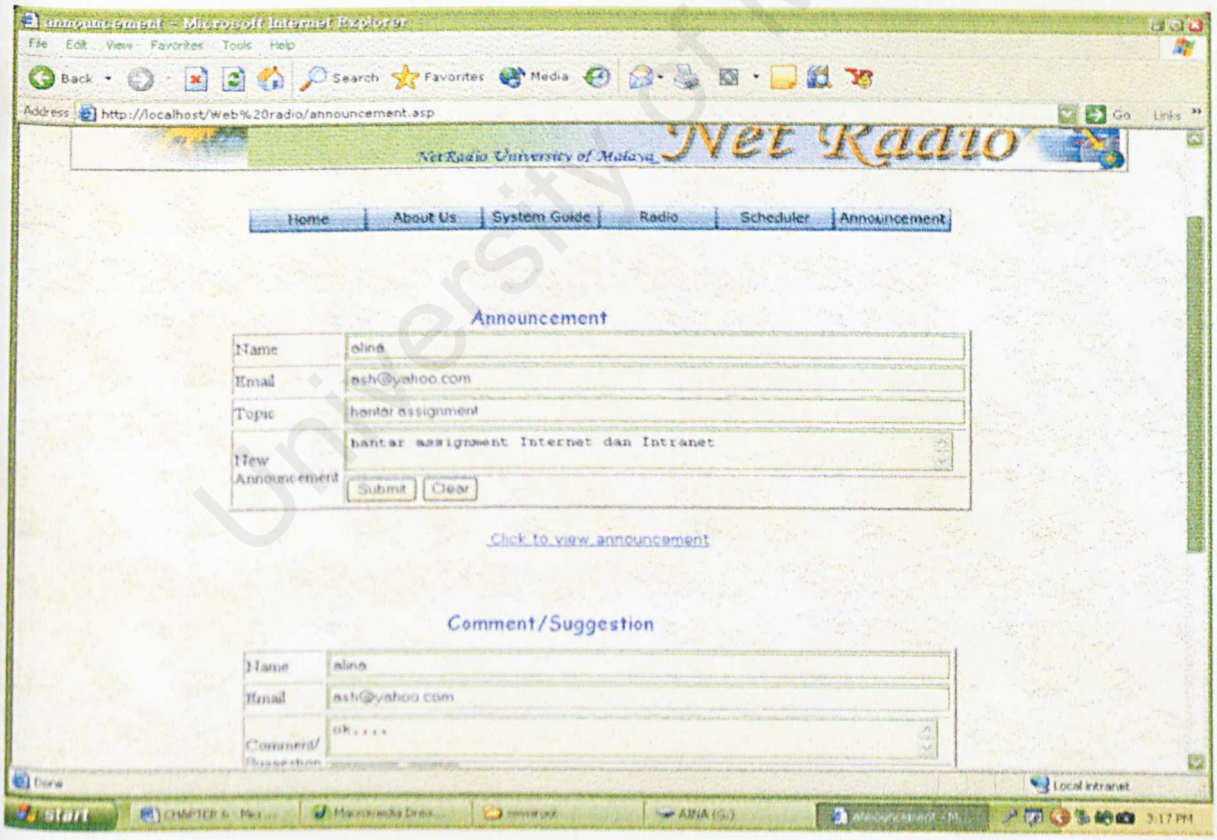

Figure 6: Announcement page

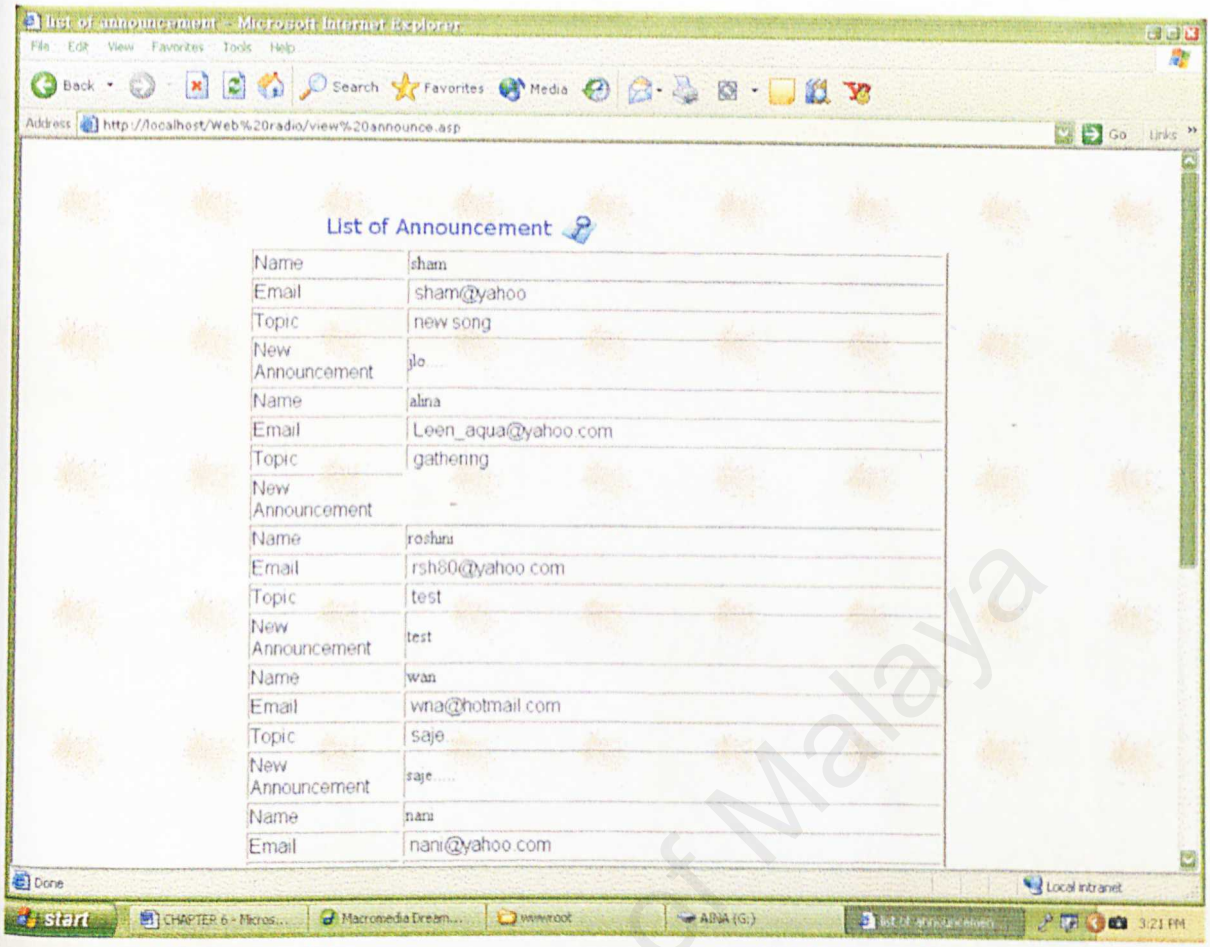

Figure 7: List of Announcement